

ANNUAL REPORT

2009-2010



Birbal Sahni Institute of Palaeobotany, Lucknow

An Autonomous Institute under Department of Science & Technology
Government of India, New Delhi

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Published by

The Director
Birbal Sahni Institute of Palaeobotany
Lucknow 226 007
INDIA

Phone : +91-522-2740008/2740011/ 2740399/2740413
Fax : +91-522-2740098/2740485
E-mail : director@bsip.res.in
 : publication@bsip.res.in
Website : <http://www.bsip.res.in>
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and
the Research Advisory Council
of the Institute for
continued support and guidance*

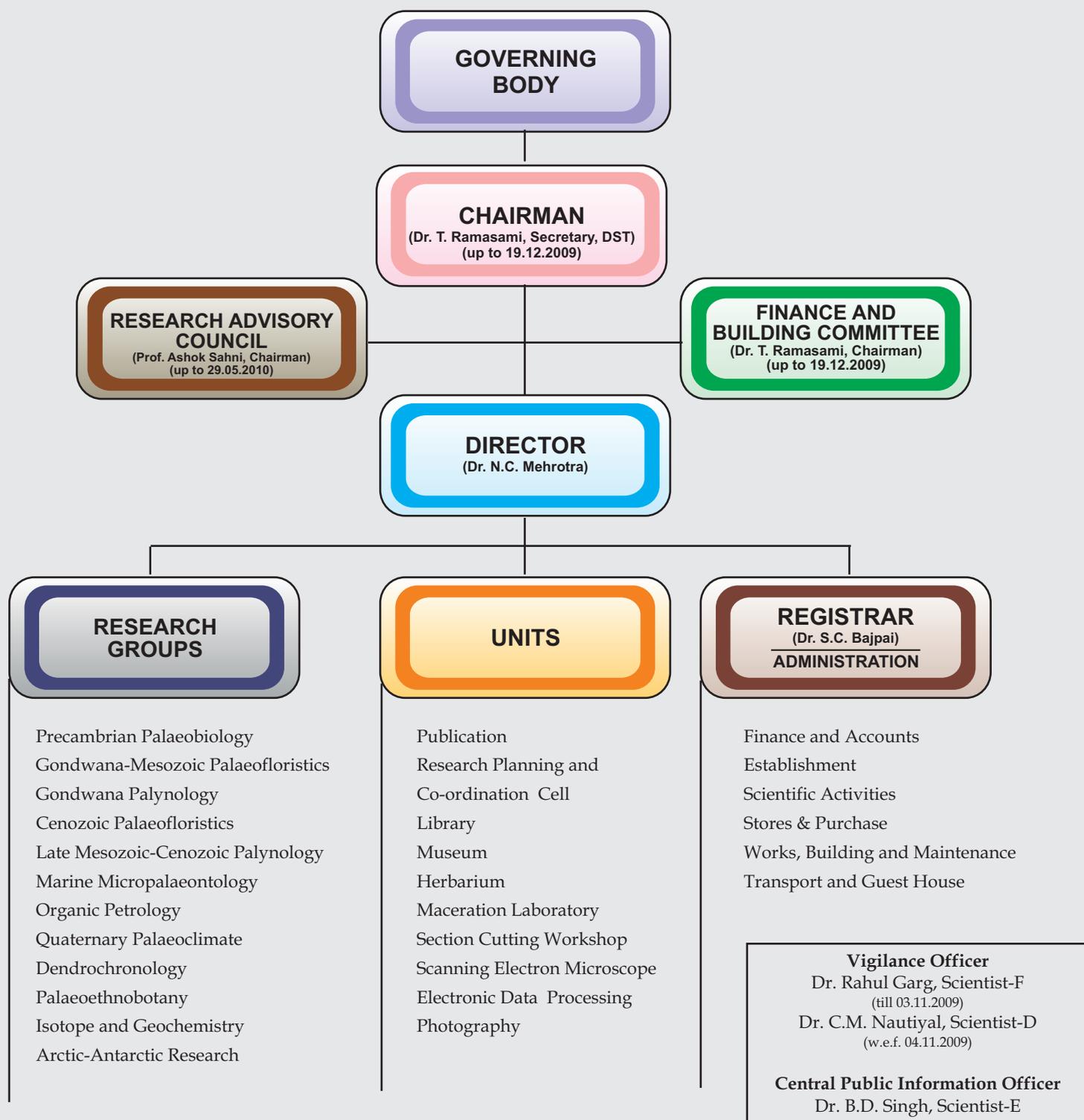
With Best Compliments

N.C. Mehrotra

Naresh C. Mehrotra
Director

Organization Structure

Department of Science & Technology Autonomous Institute



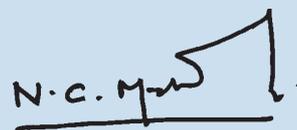
Foreword

The Birbal Sahni Institute of Palaeobotany, Lucknow, is a dedicated Research Organization actively involved in basic and applied researches pertaining to past plant relics. The applied aspects have been focussed on fossil fuel research and palaeoclimate implications. To achieve desired research goals, scientific activities during the year 2009-2010 have been reformulated and significant inputs in various frontline research areas under the umbrella of six research themes - Early life; Fossil land plant communities; Integrative Micropalaeontology, Biopetrology and Organic facies; Integrated climate change researches; Polar Sciences and Frontiers in Palaeobotanical Research have been made.

Collective efforts of scientific, technical and administrative staff resulted in accumulating data profile useful for various research agencies, universities, funding sources and related R&D units. To enhance the visibility of our efforts and the organization, various outreach programmes and international collaborations, conferences, symposia, seminars, workshops, etc. within the organization and with other organizations have been successfully coordinated.

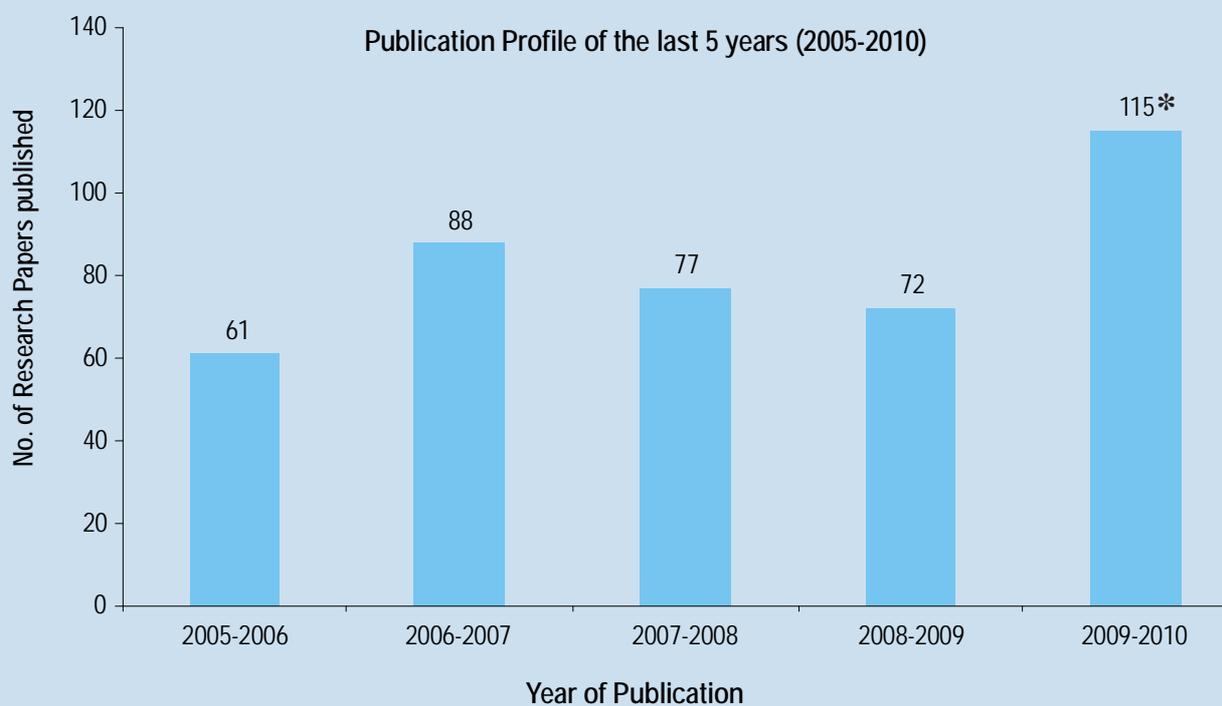
In this pursuit, the Institute has organized a joint National Conference on *Climatic Changes during the Quaternary: Special reference to Polar Regions and Southern Ocean* with National Centre for Antarctic and Ocean Research (NCAOR, Goa) which was held at NCAOR, Goa during October 22-23, 2009. To commemorate Bicentennial Birth Anniversary year of Sir Charles Darwin and Sesquicentennial year of the publication of his famous book on the Origin of Species, a conclave entitled *Conclave on Evolution–Life's Continuum* was held at BSIP, Lucknow on November 15, 2009 participated by eminent international scientists. Keeping in view induction of youth in scientific research, a training programme on *Sedimentology and Sequence Stratigraphy* was organized by the Institute during October 26-31, 2009.

I remain indebted to the members of Governing Body and Research Advisory Council for their support and guidance. I appreciate time to time help extended by the members of the Department of Science and Technology, New Delhi. I also appreciate the efforts put by members of Publication, RPCC, Museum, Administrative and Technical units for meeting the time schedule to bring out this document.

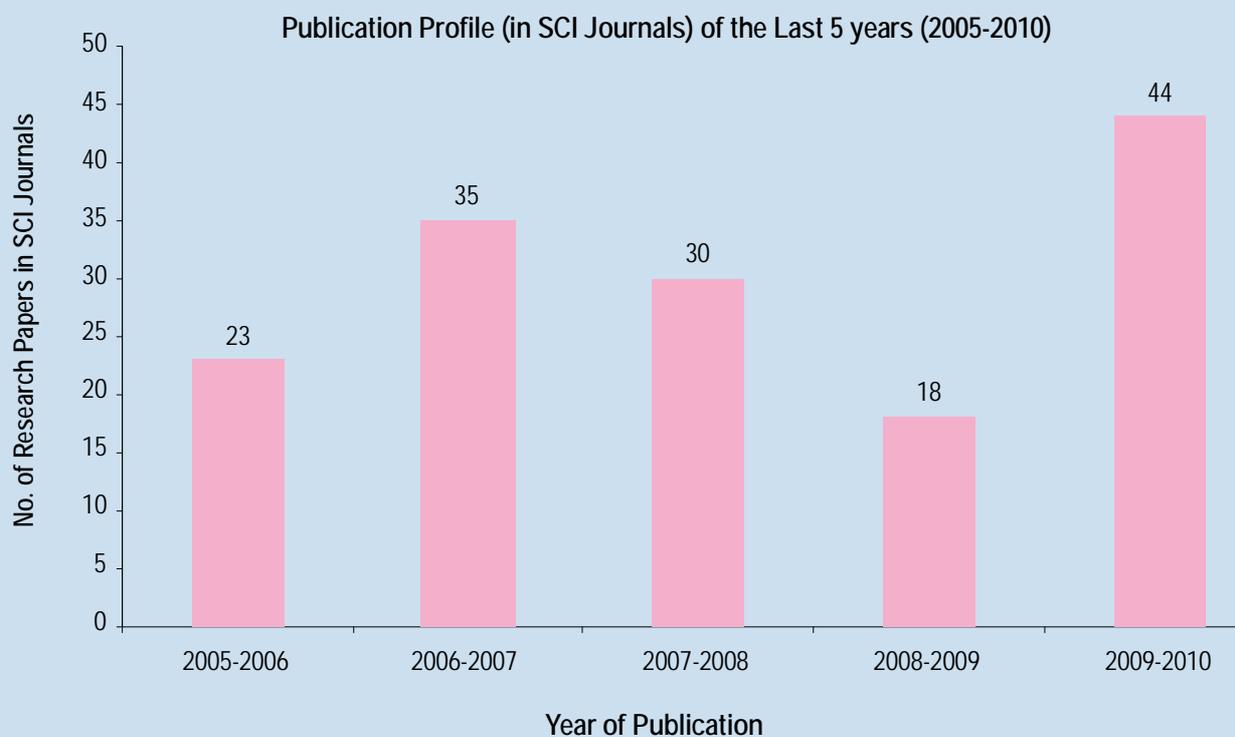


(N.C. Mehrotra)
Director

PUBLICATION PROFILE OF THE INSTITUTE



(* Including research papers accepted for publication)



(* Including research papers accepted for publication)

(ii)

Research Highlights

The Birbal Sahni Institute of Palaeobotany, an autonomous institute under the Department of Science and Technology is devoted to develop both fundamental as well as applied aspects of Palaeobotany. This is the only centre in the world where palaeobotanical researches are being conducted under one roof and the researches focused on Archaean to Recent sequences ranging in age from 3200 Ma to 400 AD. The institute is carrying out significant work on various facets of Palaeobotany through applying an integrated and multidisciplinary approach for its future growth in right direction.

To achieve the targets of the XI Five Year Plan, 14 research projects for the year 2009-2010 have been organized under the umbrella of six identified Trust Areas:

- Early life, atmosphere and oceans: Evidences from Indian Craton (Bio-Geosphere interactions in the Precambrian).
- Fossil land plant communities: Morpho-structure, Evolution, Systematics with applications to Biostratigraphy and Palaeoecology (Plant Evolution, Anatomy, Taxonomy and Stratigraphy).
- Integrative Micropalaeontology, Biopetrology and Organic facies: Relevance to fossil fuel characterization and exploration (Integrated approach to realizing economic potential in prospective basins).
- Multi-proxy parameters for Quaternary palaeoclimate reconstructions, vegetation dynamics, relative sea level changes and anthropogenic influence (Integrated approach to climate change, modeling and sustainable ecosystems).
- Polar and Major Planetary Events (Polar research and record of events such as Tsunami, Earthquakes and Volcanism).
- Frontiers in Palaeobotanical Research (Reconnaissance Projects to aid in development of future research direction).

Some significant outcome of scientific research during the year is as under:

- Thin section studies of the cherts from Bhandar Limestone and Salkhan Limestone formations of the Vindhyan Supergroup exposed in Satna district (Madhya Pradesh) revealed the occurrence of variety of cyanobacterial remains.
- Recorded organic-walled microfossils from Singhora and Raipur Groups of the Chhattisgarh Basin which show an evolutionary trend ranging in age from Latest Calymian to Cryogenian in ascending order. Two types of environmental settings for these deposits have been inferred.
- Studied diverse plant fossils from the coal-bearing areas of the Satpura Gondwana Basin. Insect burrows, having the infilling of host rock, are found in association with the *Glossopteris* flora collected from Barakar and Bijori formations of the basin.
- Recovered plant fossils from the South Rewa Basin (from Praghua and Khareri areas) are compared with various Early Cretaceous palaeofloral assemblages of India, which shows dominance of conifers and pteridophytes and absence of cycadophytes.
- Palaeoecological studies on Early Cretaceous wood fossils of Krishna-Godavari Basin indicate existence of araucarian and podocarpacean forests in the vicinity of deposition.
- Identified probable fossils of angiosperm affinity from the Raghavapuram Formation. Recovery of dissected leaf and fruit materials along with bivalves from the sequence suggests an aquatic fresh water environment.
- Continued documentation of spore-pollen assemblages from the coal-bearing sequences of Rajmahal, Birbhum, Raniganj, Tatapani-Ramkola, Sohagpur, Ib-River, and Godavari Valley coalfields in order to demarcate their significance in biostratigraphic interpretation and coal seam's correlation.

- Study of Upper Palaeozoic and Mesozoic palynomorphs in 3 bore-holes from the Deocha-Pachami area (Birbhum Coalfield) has allowed dating of the Talchir, Barakar, Dubrajpur and Rajmahal formations, and revealed alternating level of hiatuses in lithologically designated Barakar and Dubrajpur formations.
- Generated additional data on plant megafossils (leaf, wood, fruit, etc.) from the Palaeogene horizons of Rajasthan, Gujarat, Maharashtra, Himachal Pradesh, Uttarakhand, Assam and Meghalaya in terms of their palaeogeographic and palaeoecological significance, besides morphotaxonomy.
- Presence of the genus *Barringtonia* (Lecythidaceae) in Deccan Intertrappean sequence, along with number of palms, indicates the existence of tropical moist and swampy conditions in the central India.
- Analyzed the palaeobotanical data based on the leaf assemblage from the Middle Miocene sediments of Koilabas area, western Nepal in order to deduce the palaeoclimate. The nearest living relative method indicates that the fossil assemblage is overall dominated by trees; suggesting the luxuriant growth of terrestrial plant in the vicinity.
- The presence of dinoflagellate cysts along with the terrestrial floral assemblage in samples from Madhwali Nadi near Matanomadh (Kutch Basin) indicates marine transgressive phases under warm, tropical climatic conditions.
- Recovered angiosperm pollen dominated assemblage, particularly those having affinity with the families Meliaceae and Arcaceae from the base of lignite-bearing Nagaur Group (Marh Formation), Rajasthan Basin.



Members of 3rd Indian Scientific Expedition to Arctic, along with two scientists from BSIP, hoisting the National Flag on the occasion of Independence Day (15th August, 2009) at Himadri, the Indian Research Station in the Arctic.

- Recovered palynological assemblages from the Deccan Intertrappean localities, which include marker palynotaxa indicating a Maastrichtian age for Padwar, Jhilimili and Mohgaonkalan of Madhya Pradesh.
- Recorded palynoassemblage from the Tikak Parbat Formation (Late Oligocene) exposed in Tirap Colliery of Makum Coalfield, Upper Assam which indicates prevalence of swampy condition near the coast under subtropical regime.
- Recorded diverse palynofloral assemblage from the Bhuban Formation (Miocene) exposed along Unakoti road, Kailashahar district (Tripura) which indicates a marginally marine environmental condition under terrestrial influence. The presence of *Spinizonocolpites* suggests a shoreline inhabited by mangroves.
- Recorded well-preserved early Eocene dinoflagellate cyst assemblages from the Damalgiri Plant bed, Garo Hills (Meghalaya); providing evidence for precise age determination and palaeoenvironment. Also documented rich dinocyst assemblages from the Upper Maastrichtian-Selandian succession of Khasi Hills.
- Studied dinocysts and palynofacies from early Palaeogene succession (Laitryngew-Latmawksiang sections) of Cherrapunji area in order to interpret climatic and relative sea level changes across PETM interval. Excessive humid conditions at the onset of PETM event are interpreted.
- Based on the presence of well-diversified calcareous nannofossil assemblage in the Pariwar Formation, overlying the fossiliferous Bhadesar Formation in Rajasthan Basin has been precisely dated for the first time as early to Middle Albian.
- Recovered a rich palynofloral assemblage from the sediments of Port Blair Formation exposed along Andaman Trunk road at Sippighat near Port Blair and assigned an Early Oligocene age for the sequence.
- Documented coralline algal taxa belonging to families Hapalidiaceae and Corallinaceae from the limestones of the Hut Bay (Little Andaman) belonging to Middle Miocene. Interpretation on the palaeoecology based on the algal assemblage has been made.
- Evaluated Permian coals from Kothagudem area (Godavari Valley), and Tertiary lignites from Neyveli (Cauvery Basin), Matanomadh (Kutch Basin) and Tadkeshwar (Cambay Basin) areas for their categorization in terms of economic suitability, besides depositional history. High TOC content and presence of mixed Type II/ III kerogen suggest that the lignite-bearing sequence of Matanomadh has the potential to generate both oil and gaseous hydrocarbons on maturation.
- Evidenced different dataset of palynomorphs at different levels of sedimentation while pollen analysis from a 350 cm deep sediment core from eastern region of the Chilka Lake, Orissa (dated back to 1,575 ±35 yrs. BP).
- Categorized three phases of climatic oscillations on the basis of palynological study from the sediment cores (each 4-5 m deep) retrieved from Visakhapatnam coastal area, which is supported by sedimentology and geochemical status. The study shows vegetational change from wet-evergreen moist deciduous lowland forest community to dry deciduous forest during Holocene; indicating a shift in climatic conditions from warm and humid to dry and arid conditions since middle Holocene.
- Investigated dinoflagellate cysts and palynofacies assemblages from the Karawar Coast, which revealed significant variation in their vertical distribution pattern reflecting salinity fluctuations due to precipitation related freshwater terrestrial runoff.
- Studied primary productivity and runoff variations in fresh water and marine components related to NE and SW monsoon periods using biotic proxies (diatoms, palynofacies) in the Alleppey mud banks, Kerala.
- Pollen rain study of surface samples from sal forest at Kiktiha (Shahdol district), teak forest at Shahganj, and mixed forest at Sapanan (Betul district) has revealed that despite being enormous pollen producers *Shorea robusta* (sal) and *Tectona grandis* (teak) are recovered with average 1.5% pollen each; attributing to their poor preservation in the sediments.

- Evidenced the occurrence of *Cerealia* palynomorph in sedimentary profile (2.20 m deep) along with *Rumex* and *Xanthium* in high values, which may attribute intensive anthropogenic impact causing deterioration of nearby forest and expanding the Hapoli-Ziro valley area (Arunachal Pradesh).
- Crossdated Himalayan pencil juniper samples from Lahaul, Himachal Pradesh and extended its ring-widths chronology back to AD 1400, which showed strong negative relationship with temperature and direct relationship with monthly precipitation during the growing season.
- Wood charcoal from Chalcolithic site Naimisharyan/ Neemsar, District Sitapur (UP) was investigated anatomically in order to reconstruct the regional forest wealth, ecological conditions and exploitation by the ancient settlers during Sunga-Kushana period. The wood charcoals have been identified as belonging to the timbers. Also studied carbonized samples from a Harappan site at Kanmer, Kutch district (Gujarat).
- An attempt has been made using the geomorphometric approach to assess the Spiti river basin for neotectonic instability and landscape evaluation. Also studied the Khalsar paleolake deposit along the Karakoram Fault Zone (KFZ) in Trans-Himalaya, through magnetic mineralogy and magnetic fabric analyses, to correlate its fabric with local and regional deformation events.
- The calibration for C¹⁴ dates is being carried out as per available latest softwares extending the calibration to about 50,000 yrs BP.
- A comprehensive study of lichen samples from Schirmacher Oasis (East Antarctica) reflects occurrence of palynodebris including local cryptogams, exotic angiosperm and conifers; indicating long distance thermophilic pollen dispersal over Antarctica in regular basis.
- Studied two sedimentary sections from Schirmacher Oasis for mineral magnetic parameters, which show good climatic variations (magnetozones). Also generated high resolution mineral magnetic data on the Quaternary core raised in the Kolhamna lagoon, Ny Alesund (Arctic).
- Studied megafossils from Weller (Permian) and Lashly (Triassic) formations of Allan hills, Transantarctic Mountains, South Victoria Land. Work on floral and sedimentary organic matter characterization from Triassic of Allan Hills has also been carried out. The floral assemblage indicates fluvial and non-marine lacustrine conditions. The study further indicates thermal alteration of the material.
- Studied megafossil specimens from the sediments of Kuling Group (Permian) near Guling village and from the Carboniferous sediments exposed near Poh, Nadang, Tabo and Lari villages in the Kaza district of Spiti Valley.
- Recorded a diverse assemblage of palynomorphs along with rich and varied organic matter from the samples of Neyveli Lignite field (Tamil Nadu); indicating Early to Middle Eocene age and coastal environment of deposition.

Help to industry (ONGC)— Palaeobiological studies from the Ganga Basin reveal significant data suggesting Cryogenian to Ediacaran age for the Madhubani Group. The studies indicate possibility of hydrocarbons in Ganga Basin. The biotic assemblage is comparable to Marwar Supergroup of Bikaner-Nagaur Basin, which is already known to contain hydrocarbons.

The collective research efforts are expressed in the form of 72 published papers, 70 conference/symposia abstracts, besides 44 research papers accepted for publication. Six scientists were deputed abroad (Brazil and Germany). Two scientists participated in the 3rd Indian Scientific Expedition to Arctic. Thirty-two scientists, six research students and two technical personnel were deputed to attend various national and international conferences/ workshops. Forty-eight research papers were presented in these meetings at different centers of India and Brazil. All the scientists were also deputed to attend the Conclave “Evolution: Life’s Continuum” organized at BSIP. Seventy-nine research papers were presented at different centers of India in these meetings. A training programme on Sequence Stratigraphy was also organized by the Institute with the help of faculties from Jadavpur University, Kolkata.

Governing Body



Chairman

(w.e.f. 20.12.2006 to 19.12.2009)

Dr. T. Ramasami
Secretary
Department of Science and Technology
Technology Bhavan, New Mehrauli Road
New Delhi-110 016

Members

Shri K.P. Pandiyan
Joint Secretary & Financial Adviser
or his Nominee, DST
Technology Bhavan, New Mehrauli Road
New Delhi-110 016

Professor Manju Banerjee
Flat No. 205 & 206
Arpan Complex
58A, N.C. Choudhary Road
Kolkata-700 042

Sri V.K. Sibal
Director General
Directorate General of Hydrocarbons
4th Floor, Hindustan Times House
18-20, Kasturba Gandhi Marg
New Delhi-110 001

Professor G.V.R. Prasad
National Institute of Technical Teachers
Training and Research,
FC Block,
Sector III, Salt Lake
Kolkata-700 064.

Dr. B.R. Arora
Director
Wadia Institute of Himalayan Geology
33, General Mahadeo Singh Road
Dehradun-248 001

Dr. V. Purnachandra Rao
Scientist-F
National Institute of Oceanography
Dona Paula
Goa-403 004

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(w.e.f. 30.05.2007 to 29.05.2010)

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F-28, Sector-25,
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Dr. N.C. Mehrotra
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Members

Dr. B.R. Arora
Director
Wadia Institute of Himalayan Geology
33, General Mahadeo Singh Road
Dehradun-248 001

Professor S.N. Bhalla
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Aligarh Muslim University
A-525, Sarita Vihar
New Delhi-110 076

Professor M.P. Singh
CAS in Geology
Lucknow University
Lucknow-226 007

Professor C.L. Verma
Department of Botany
Lucknow University
Lucknow-226 007

Sri Rasik Ravindra
Director
National Centre for Antarctic & Ocean
Research (NCAOR)
Headland Sada, Vasco da Gama
Goa-403 804

Dr. M. Shanmukhappa
Dy. General Manager (Palynology)
Oil and Natural Gas Corporation Ltd.
Western Onshore Basin
Makarpura Road
Vadodara-390 009

Dr. Rajeev Nigam
Head, Geological Oceanography Division
National Institute of Oceanography
Dona Paula
Goa-403 004

Dr. M. Prithviraj
Scientist-F
Department of Science & Technology
New Mehrauli Road
New Delhi-110 016

Dr. Balesh Kumar
Consultant
National Geophysical Research Institute
Uppal Road, Hyderabad-500 007

Sri Sunil Srivastava
Dy. Director General
Directorate General of Hydrocarbons
C-139, Sector 63, Noida-201 301 (Uttar Pradesh)

Dr. S.D. Bonde
Agharkar Research Institute
G.G. Agarkar Road
Pune-411 004

Dr. Navneet Kumaran
Agharkar Research Institute
G.G. Agarkar Road
Pune-411 004

Non-Member Secretary (Ex-officio)

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(w.e.f. 20.12.2006 to 19.12.2009)

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Shri Ajai K. Srivastava
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P.O.- Tel Bhawan
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Director
Birbal Sahni Institute of Palaeobotany

Non-Member Secretary (Ex-officio)

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Foundation Day

The Institute celebrated its 63rd Foundation Day on September 10, 2009. On this occasion Dr. Shailesh Nayak, Secretary, Ministry of Earth Sciences, Govt. of India, New Delhi delivered '13th Jubilee Commemoration

Lecture on the topic *Towards Climate Information and Services*.

Many guests and scientists from outside the Institute along with Institute's staff attended the function.



Founders' Day

The Institute celebrated its Founder— Prof. Birbal Sahni 118th birth anniversary on November 14, 2009 as Founders' Day. The Institute's staff and distinguished guests from other organizations offered *Pushpanjali* on the *Samadhi* of the Founder Professor Birbal Sahni, FRS in the campus. Same day in the evening following two Memorial Lectures were organized:

Dr. J. William Schopf, Department of Earth and Space Sciences, Institute of Geophysics and Planetary Physics, University of California, Los Angeles, USA

delivered the '55th Sir Albert Charles Seward Memorial Lecture on the fascinating topic *The Earliest History of Life: Solution to Darwin's Dilemma*.

Dr. Dianne Edwards, FRS, School of Earth and Ocean Sciences, Cardiff University, Cardiff, UK delivered the '39th Birbal Sahni Memorial Lecture on the topic— *Tracing 'Roots' in early Terrestrial Ecosystems*.

Many guests and scientists from outside the Institute and several conclave delegates attended the occasion.



Diamond Jubilee Lecture

Dr. V.P. Dimri, Director, National Geophysical Research Institute, Hyderabad delivered the '4th Diamond Jubilee Lecture' on the theme *Geological Sequestration of Carbon di Oxide (CO₂) for Enhanced Oil Recovery* (January 02, 2010). On the same day, tributes were paid to Dr. BS Venkatachala, former Director, BSIP and his contributions were remembered. Remeniscences by his colleagues were expressed. On this occasion various medals to young research scholars were awarded.



National Science Day & Outreach Programmes

As ever, Institute celebrated the National Science day through a number of activities targeted at the city students as well as Institute scientists during February, 2010.

As a special programme, renowned science journalist Dr. (Mrs) Laitha Vaidyanathan, PTI, Mumbai was invited to interact with Institute scientists, especially the younger lot. She addressed the Institute scientists on 25th January on nuances of communicating science to

public especially Palaeobotany, and provided important tips.

The students of Lucknow and near-by areas were contacted for the Science Day programmes. Sixty- seven students of class VI to XII submitted entries for the essay competition on *A Healthy Woman means Healthy Family*. Five entries from the junior (VI- VIII) and 8 from the senior group students (IX- XII) were selected by the judge Mr. V.K. Joshi, former Director, GSI for





prizes. On 13th of February, Science- films were shown and Science Quiz was organized in the Institute auditorium. Out of 172 contestants, 6 from the junior (VI-VIII) and 6 from the senior group (IX- XII) were selected for prizes. The programme also included poster and collage competitions for students of class V to IX on *The Secret of Good Health*. Out of 112 participants, the judges, Shri A.K. Deo, Secretary, Lalit Kala Kendra (Regional Centre), Lucknow, and Shri S. Kumar, Project Coordinator, Regional Science City, Lucknow selected 14 entries for the poster and 11 for the collage prizes.

The Science Day programme concluded on February 25, 2010 which was also observed as the Open House. The renowned doctor Prof. Dr. S. Chooramani Gopal, Vice- Chancellor, CSM Medical University, Lucknow was the Chief Guest. The function was also cojoined with Rajbhasha Workshop and Dr. Chooramani spoke in Hindi. Dr. N.C. Mehrtotra, Director BSIP welcomed the Chief Guest. Dr. C.M. Nautiyal, Coordinator of the Science Day presented a brief report on Science Day celebrations, while Dr. A.K. Srivastava proposed the Vote of Thanks. Prof. Chooramani gave

away prizes to the 63 prize-winners of Science Day competitions.

The Institute also actively participated in the Science EXPO-2010 organised at Regional Science City during January 28- February 01 with Dr. N.C. Mehrotra involved as a Patron and Dr. Nautiyal as a member of the Organising Committee. Dr. Mehrotra also chaired the Inaugural session where HE Governor of Uttar Pradesh, Shri B.L. Joshi was the Chief Guest. Dr. Mehrotra's lecture was widely quoted by the newspapers on the importance of showcasing the excitement of science to children to motivate them for taking up career in science. Institute also put up a pavilion exhibiting fossils and posters for all the 5 days which attracted a large number of visitors, and was also visited by HE Governor of Uttar Pradesh, Shri Joshi jee. Dr. C.M. Nautiyal compered the inaugural session and also gave a lecture on the concluding day of the EXPO.

Institute's Museum continued to remain an attraction and a large number of people visited Museum as well as the Radiocarbon Laboratory and the Scanning Electron Microscope section all through the year. Institute scientists interacted with city students at various forums and delivered lectures in institutions in several cities.

Conference- Climatic Changes during the Quaternary

Quaternary, the most recent period of the earth's time-history, spans the past ~2.6 million years during which the earth underwent several cycles of glaciation (cooling) and deglaciation (warming). This period has witnessed a drastic change in the earth's temperature, rise and fall of sea levels, contraction and expansion of the continental ice-sheets, advance and retreat of glaciers and above all an exponential increase of the human population. The rapid warming of the globe during the recent past, is a matter of grave concern, and makes it necessary to understand the ever changing climate system of the Earth, which can be better addressed by studying its past variations.

Since the National Centre for Antarctic and Ocean Research (NCAOR, Goa) is the nodal agency that coordinates research activities in the Polar Regions in which the BSIP is playing a major role with regards to palaeo-climatological studies, it was thought pertinent that the two Institutes come together and jointly host a National Conference on *Climatic Changes during the Quaternary: Special reference to Polar Regions and Southern Ocean*. The conference was held at the International Centre, Goa during October 22-23, 2009.

The Conference was inaugurated by the Chief Guest, Dr. Dileep Deobagkar, Vice Chancellor, Goa University, who laid emphasis on the multi-disciplinary requirement of present day research and congratulated the scientists present from all over India for their efforts in interpreting the different Earth System Processes. Sri Rasik Ravindra, Director NCAOR, welcomed the delegates and gave a broad overview of the efforts being made in Polar research in the country. Dr. N.C. Mehrotra, Director BSIP, introduced the theme of the Conference and stressed the need to develop collaborative programmes to have a better impact on Polar climatic studies. Dr. M. Ramakrishnan, Ex-Senior Dy. DG, GSI, the Guest of Honour, spoke on the need for a better understanding of climate change issues so that it may be able to fulfill the needs and aspirations of the society.

The inaugural function was followed by an invited key-note lecture by Prof. Robert A. Spicer of Open University (UK), entitled *Polar Perspectives: Past, Present and Possible*. He stressed that understanding climate dynamics at both the Poles is an international priority because it not only relates to sea level rise but also ocean circulation and deep ocean oxygenation. He elucidated that Polar fossil records provide invaluable data

regarding high latitude forests during times of previous global warmth, and warned that we are rapidly moving towards that phase again due to warming of the earth during the present times. Dr. Spicer strongly advocated for more inclusion of palaeobiological data to have a better understanding of Global Change issues.

Scientists from 27 Institutes and Universities from India and 6 from overseas Institutions contributed papers in the Conference. Among them, about 60 delegates from 16 organisations, such as NCAOR, BSIP, NIO, GSI, IITM, SASE, NGRI, IIT (Kharagpur), and a number of Universities attended the Conference, including one each from UK and USA. In all, 62 papers, including posters, were presented during the Conference from participants all over India that showed the dimensions of Indian scientific activities in the Polar Regions and Southern Ocean. The major highlight of the Conference was the active participation of research scholars and young scientists who presented the majority of the papers. Awards were given to three best poster presentations by young scientists, below 35 years of age.

A wide range of papers on studies being conducted in Antarctica over the years were presented, dealing on various aspects. The papers on studies dealing with ice cores presented several important findings such as existence of anomalous sulphate peaks related to large volcanic events that are historically recorded, including the Mt. Pinatubo (1991) eruption in Philippines. Oxygen and hydrogen isotope record of an ice core representing the past 100 years from the east Antarctic revealed that the core site experienced a significant warming of 1°C over the past 100 years. Other papers dealt with biogeochemistry of sulfur species and distribution of methanesulfonate (MSA) in snow samples from coastal Larsemann Hills; biological studies, landscape evolution and multi-proxy palaeoclimatic studies around the Schirmacher Oasis. Studies from the Southern Ocean showed that diatoms' abundance is more pronounced as fossil forms as compared to living forms in water column due to unstable environmental conditions.

Profiles of multiple proxy records like oxygen isotope, mineral magnetism, ice-rafted detritus (IRD), organic carbon, biogenic silica (opal) as well as trace metal parameters in sediment cores from the Southern Ocean revealed significant changes in the deposition of biogenic and terrigenous material at the study site in tandem with

the regional and global climate changes. Papers on Pre-Quaternary climatic changes in the Polar Regions compared the Gondwana Flora of Antarctica with India and brought out the importance of plant fossils in such studies. A few papers also highlighted the budding Indian efforts in the Arctic region with emphasis on Quaternary climatic changes.

The Conference focussed on both the basic and applied aspects of the use of different tools and proxies in deciphering climate change. Eminent speakers in the

concluding session stressed the need for having a better understanding of the past climatic cycles of the earth to predict the future so that it may be beneficial to the society. It was also suggested to organize such Conference every alternate year so that progress in the Indian efforts in the Polar Regions can be shared among the concerned Institutions and further policies formulated accordingly. The Conference provided a platform to the Indian scientific community to discuss developments in their respective fields and develop mutual collaborative programs for future studies.



A view of the Inauguration ceremony

Conclave- Evolution: Life's Continuum

In the Bicentennial Birth Anniversary year of Sir Charles Darwin and Sesquicentennial year of the publication of his famous book on the *Origin of Species*, a conclave entitled *Evolution-Life's Continuum* was organized by the BSIP on November 15, 2009. Ten eminent research workers on evolution delivered theme oriented lectures. Scientific staff members of the institute, research scholars, leading researchers and academic staff members from Botany, Geology, Zoology, and Anthropology departments of the University of Lucknow participated in the conclave. These lectures prompted the scientific fraternity of the Lucknow to think over the contributions of Sir Charles Darwin in the field of plant, animal and human evolution.

Prof. Vidyanand Nanjundiah, Centre for Ecological Sciences & MRDG, Indian Institute of Science, Bangalore, delivered a talk on *150 years after The Origin of Species*. This book is considered a watershed in the history of science. It established that living forms were products of organic evolution, a process of transformation that involved modification by descent and diversification. It also propounded the means of Natural Selection by which evolution could take place. The natural selection can be seen as the first step in our recognition of life as a property of matter and of biology as the science of living matter. In fact, the essence of natural selection was summarized in terms of three features: 'random variation', 'heritability', and 'differential fitness'.

Prof. J.W. Schopf, Department of Earth and Space Sciences, University of California, Los Angeles, USA, spoke on the topic *Fluorescence (CLSM) and molecular-structural (Raman) imagery: New methods to investigate the Precambrian history of life*. He demonstrated that how the problems of the study of the permineralized fossils can be addressed by the use of two techniques recently introduced to Palaeobiology: Confocal Laser Scanning Microscopy (CLSM) and Raman Imagery. These techniques, both of which are non-intrusive and non-destructive, can provide data by which to characterize, *in situ* and at submicron resolution, the cellular and organismal morphology of thin section-embedded organic-walled fossils.

Dr. S.A. Jafar, 5-B Whispering Meadows, Haralur Road, Bangalore, delivered a talk on *What Darwin missed: Relative Magnitude dictates Survival-extinction*. He suggested that nothing is big or of small

magnitude except by comparison; there is no absolute size in universe, it is boundless towards both big and small. It was shown that this observation can be applied on the life forms preserved in the geological records. The relative magnitude model finds application in social, economic and biologic fields.

Prof. Dianne Edwards, Cardiff University, Main Building, Park Place, Cardiff, UK, delivered a lecture on *The Colonisation of the Land: The struggle for Survival*. She showed in that it provides evidence for the origination, diversification and extinction of groups of organisms through geological time, the fossil record is indispensable to evolutionary theory. This was appreciated by Darwin although he showed little interest in palaeobotany. However, he did discover a petrified forest of *Araucarioxylon* in Argentina and collected specimens comprising permineralised, mainly conifer, wood in S. America and Australia as well as some *Nothofagus* leaves during the voyage of the Beagle. Indeed one of his most quoted phrases was palaeobotanical. His frustration at the lack of evidence to explain away the sudden appearance of angiosperms similar to modern forms led to his "abominable mystery". Prof. Edwards traced the history of early land plants studies.

Prof. Ashok Sahni, Centre of Advanced Study in Geology, Panjab University, Chandigarh, delivered a lecture on *Indian Amber: Evolving Insects and Microbiota on the Drifting Plate*. He showed that the present day biodiversity is overwhelmingly dominated by insect, arthropod and plant species in comparison to other groups of organisms. The fossil record of insects though not poor, is still far short of being representative of the great diversification that exists today. The find of amber in Palaeocene-Lower Eocene western margin lignite deposits in the last five years has opened a new window not only for the chemistry and stratigraphic implications of the amber, but also in classical terms, the taxonomy, relationships and evolutionary history of embedded insect inclusions in the light of geodynamic framework of the Indian Plate. He concluded that the Indian Eocene amber provides a fine-scale evolutionary record of embedded inclusions in a manner that imprint or carbonized remains do not allow.

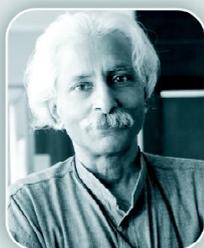
Prof. Manju Banerjee, Department of Botany, University of Calcutta, Kolkata, spoke on *Diversity and inter-relationship in the Glossopterid group in*

CONCLAVE

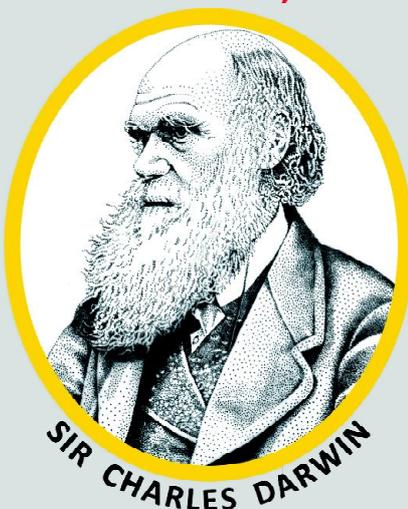
EVOLUTION: LIFE'S CONTINUUM

Celebration of
BICENTENNIAL BIRTH ANNIVERSARY

&
Sesquicentennial of Origin of Species
15th November, 2009



Vidyanand Nanjundiah,
Indian Institute of Science, Bangalore



SIR CHARLES DARWIN



Ashok Sahni
Panjab University, Chandigarh



David Dilcher
University of Florida, USA



Rajiv Nigam, NIO, Goa



Lalji Singh, CCMB, Hyderabad



Syed A. Jafar, Bangalore



Manju Banerjee, Kolkata



J. William Schopf, UCLA, USA



J. Shen-Miller, UCLA, USA



Dianne Edwards
Cardiff University, UK



BIRBAL SAHNI INSTITUTE OF PALAEOBOTANY

53 University Road, Lucknow -226 007, INDIA

ORGANIZING COMMITTEE

N. C. Mehrotra, A. Rajanikanth, Mukund Sharma, Madhav Kumar and Amit K. Ghosh

understanding Evolution of plants. She showed that fossil plant studies have shown each group of the late Palaeozoic gymnosperm including Glossopterids has adopted special features in their course of evolution. Gymnosperm is the immediate ancestor of the angiosperms. As such, attention has been given to each and every group of gymnosperms to trace the possible ancestry of angiosperms. However, the Glossopterids have acquired an important position in the consideration of evolution of angiosperms both in the morphological and cladistic analyses.

Prof. Jane Shen-Miller, Department of Organismic Biology, Ecology and Evolution, University of California, Los Angeles, California, USA spoke on the topic *Exceptional longevity of fossil seeds of sacred lotus, Nelumbo nucifera: Survival of the fittest.* She established that seeds of sacred lotus (*Nelumbo nucifera*) are among the longest viability known in plants, 1300 years, ranking them as prime examples of Darwinian evolution's "survival of the fittest." As Darwin's interest expressed in the *Vitality of Seeds* (1843), she discussed, the remarkable long-term viability of *Nelumbo* seeds, now documented for many radiocarbon-dated specimens of hundreds of years in age.

Dr. Rajiv Nigam, National Institute of Oceanography, Dona Paula, Goa, presented the recent work on *Climatically controlled changes in reproductive behaviour of Benthic Foraminifera: A precursor to evolution.* He demonstrated many morphological features associated with evolution in foraminifera like septations, arrangements of chambers (biserial, triserial and multiserial), different coiling arrangements (planispiral to trochospiral and dextral to sinistral), nature of wall structures etc. They evolved by adaptation, which allow them to cope with changing environment regimes, exploit new environments, diversify, and function efficiently. One of the most prominent methods of adaptation in foraminifera involves reproduction.

Dr. Lalji Singh, Centre for Cellular and Molecular Biology Uppal Road, Hyderabad, presented the results of recent studies on *Mystery of our Origins.* He posed many questions. His recent study that is published in the *Journal Nature* answered them were presented. Since the dawn of civilization Man has been asking this question who are we? Where have we come from? Until 1858 it was universal belief that man is special creation of God. In 1858 based on phenotypic transition of various organisms including plant and animal species Charles

Darwin proposed the theory of evolution and wrote a book on '*Origin of Species*'. Eight years later, Darwin in 1871 wrote a book on '*The Descent of Man*'. Today it is widely accepted view that modern human diverged from a common ancestor of chimpanzee and human nearly 6-7 million years ago. Based on fossil records found in Africa, it is now believed that modern human originated from a single mother about 160,000 years ago in East Africa. Due to East-African mega-droughts between 135 and 75 thousand years ago, when the water volume of the Lake Malawi was reduced by at least 95% could have caused their migration out of Africa. Which route did they take? Our study of the tribes of Andaman and Nicobar Islands using complete mitochondrial DNA sequences and its comparison with the mitochondrial DNA sequences of the world populations available in the database led to the theory of southern coastal route of migration through India, against the prevailing view of northern route of migration via Middle East, Europe, south-east Asia, Australia and then to India. Our earlier study revealed that Negrito tribes of Andaman and Nicobar Islands, such as Onge, Jarawa, Great Andamanese and Sentinelese, are probably the descendants of the first man who moved out of Africa.

Prof. David L. Dilcher, Affiliate Professor of Botany, Florida Museum of Natural History, University of Florida, Gainesville, USA, delivered a talk on *The ever changing Continuum of Life in the Evolution of Land Plants.* He stressed that in order to understand basic concepts of the major groups of land plants we must study their reproductive biology. Of particular interest are the major steps that lead to the evolution of the angiosperms. This major group of plants in the world today comes from a seed plant ancestry with the male and female reproductive organs borne on separate plants or separate leaves of one plant. The angiosperms developed syndromes to promote pollination events using insects of the Mesozoic to accomplish this. They brought both male and female organs together, but this had the potential to allow self pollination. The closing of the carpel promoted out crossing and also was accompanied by the development of self incompatibility. The closed carpel should define the angiosperms. Later sterile organs evolved which resulted in the evolution of the flower.

The conclave generated a great interest among the participants. People interacted with experts. In the evening the Conclave concluded with a valedictory function where experts and participants expressed their views about the meeting and lessons they learnt and questions that are yet to be addressed.

Training -Sedimentology & Sequence Stratigraphy

BSIP organised a professional course on *Sedimentology and Sequence Stratigraphy* for the scientific staff and research scholars of the Institute during October 26-31, 2009. Department of Geological Sciences, Jadavpur University (Kolkata) had co-ordinated a course involving resource persons from Jadavpur and other Universities and organizations of the country. The following eminent resources persons were involved in conducting the programme:

Prof. P.K. Bose, Department of Geological Sciences, Jadavpur University, Kolkata

Prof. P.K. Saraswati, Department of Earth Sciences, IIT Bombay, Mumbai

Prof. P.P. Chakraborty, Rajiv Gandhi Institute of Petroleum Technology, Rae Bareli

Prof. R. Nagendra, Department of Geology, Anna University, Chennai

Dr. Sanjib K. Biswas, Department of Earth Sciences, IIT Bombay, Mumbai

Dr. Subir Sarkar, Department of Geological Sciences, Jadavpur University, Kolkata and

Dr. Sandeep Rai, British Gas, Mumbai,

The present programme was to introduce Sedimentology and Sequence Stratigraphy to an assembly of scientists whose interest lie within sediments, Quaternary or ancient. Before delving into Sequence Stratigraphy they were introduced depositional facies and seismic facies to interpret from ancient formations and how the space to accommodate sediments was created or eliminated, through time as well as space. Subsurface data is not readily available and one has to depend on outcrops solely, the course emphasized application on outcrops.

There were fifteen lectures:

- Depositional facies in the context of Sequence Stratigraphy,

- Lithostratigraphy and Chronostratigraphy,
- Principles of Sequence Stratigraphy,
- Seismic expression and Configuration and Log-based Sequence Correlation,
- Carbonate Sedimentation, Distribution and Sequence Building,
- Application of Palaeontology in Sequence Stratigraphic Analysis,
- Application of Sequence Stratigraphy: An approach– A case study from the Cretaceous of southern India,
- Sequence Stratigraphic approach Non-marine Formations,
- Application of Sequence Stratigraphy for Oil Exploration in Indian Sedimentary basins
- Sea level fluctuations,
- Carbonate Platform and Sequence Building,
- Stratigraphy, Sequence and Sedimentation processes: An example from Kutch Basin,
- Application of Petrography, Ichnofacies in Sequence Stratigraphy,
- Application of Palynology in Sequence Stratigraphy, and
- Stratigraphic signature of a Sea level change, Basin Floor wobbling, Sedimentation rate and Climate.

The most important part of the training was the practical exercises suitably designed for palaeontological usage. A field visit to apply knowledge gained is also planned in near future at appropriate time.

This training was attended by scientific staff and research scholars of the Institute. A valedictory session was graced by two local RAC Members, viz. Prof. M.P. Singh and Prof. C.L. Verma and they had interaction with all the participants.



P.K. Bose



R. Nagendra



P.K. Saraswati



P.P. Chakraborty



Sandeep Rai



Subir Sarkar

Distinguished Visitors

- Dr. Shailesh Nayak, Secretary, Ministry of Earth Sciences, Govt. of India, New Delhi
- Prof. Dianne Edwards, Cardiff University, Cardiff, UK
- Prof. J W. Schopf, University of California, Los Angeles, USA
- Dr. V.P. Dimri, Director, National Geophysical Research Institute, Hyderabad
- Prof. Vidyanand Nanjundiah, Indian Institute of Science, Bangalore
- Dr. Lalji Singh, Centre for Cellular & Molecular Biology, Hyderabad
- Prof. David L. Dilcher, University of Florida, Gainesville, USA
- Prof. Jane Shen-Miller, University of California, Los Angeles, USA
- Prof. Manju Banerjee, University of Calcutta, Kolkata
- Prof. P.K. Bose, Jadavpur University, Kolkata
- Prof. P.K. Saraswati, Indian Institute of Technology Bombay, Mumbai
- Dr. Sanjib K. Biswas, Indian Institute of Technology Bombay, Mumbai
- Prof. P.P. Chakraborty, Rajiv Gandhi Institute of Petroleum Technology, Rae Bareli (Uttar Pradesh)
- Dr. Subir Sarkar, Department of Geological Sciences, Jadavpur University, Kolkata,
- Dr. Sandeep Rai, British Gas, Mumbai
- Prof. R. Nagendra, Anna University, Chennai
- Dr. Akhilesh Gupta, Advisor, DST, New Delhi
- Dr. Yu-Fei Wang, Institute of Botany, Beijing, China
- Dr. (Mrs.) Lalitha Vaidyanathan, Press Trust of India, Mumbai
- Shri Naveen Joshi, Chief Resident Editor, The Hindustan Newspaper, Lucknow



Prof. Dianne Edwards, Cardiff University, Cardiff, UK observing rock specimens displayed in the museum

Research

Project Work

Thrust Area : EARLY LIFE, ATMOSPHERE AND OCEANS: EVIDENCES FROM INDIAN CRATON (Bio-Geosphere interactions in the Precambrian)

Precambrian Palaeobiology Group

Project 1.1: Palaeobiology of the Neoproterozoic Marwar Supergroup and the Bhandar Group of Vindhyan Supergroup: biostratigraphical correlation

Petrographic thin section studies of the cherts of the Bhandar Limestone and Salkhan Limestone formations of the Vindhyan Supergroup exposed in Satna district have demonstrated the presence of a variety of cyanobacterial remains belonging to Chroococaceae, Oscillatoriaceae, Entophysalidaceae and Chlorococaceae. Study of these microfossils under Confocal Laser Scanning Microscope (CLSM) and their Raman Spectroscopic Analysis (RSA) is being attempted to understand their true biological affinity and status. A manuscript on bio-mat structures of the Sonia Sandstone Formation, Marwar Supergroup has

been finalized.

Undertook field work in central India for the collection of samples from Upper Vindhyan. In connection with the organization of the International Field Workshop a reconnaissance survey has been made in the Chitrakoot, Satna, Rewa, Sidhi and Chhattarpur districts for marking and flagging the stops for the Workshop on Vindhyan Supergroup. Later in January, a field work was conducted with the participants of the Workshop.

Mukund Sharma



Project 1.2: Tracing the palaeobiological entities from the eastern part of Chhattisgarh Basin with geologic implications

Studied the microbiotic assemblage from the samples belonging to Singhora, Chandarpur and Raipur groups collected from the outcrops exposed in Mahasamund, Raigarh and Raipur districts. Structurally, three/ two dimensional, cellularly preserved microbiota (27 genera) comprising prokaryotes and eukaryotes have been observed both in petrographic thin sections as well as in macerated residues of Chhuipali Formation (Singhora Group), and Charmuria and Gundardehi formations (Raipur Group) belonging to Baradwar subbasin exposed in eastern and southeastern parts of Chhattisgarh Basin. 16 organic-walled microfossils (OWM) genera comprising 10 genera of acritarchs and 6 genera of cyanobacterial remains have been recovered from the variegated shales of Chhuipali Formation exposed in and around Toresingha area of Mahasamund district. 23 OWM genera are of two types– i) 11 genera of acritarchs; ii) 11 genera of cyanobacterial remains and single genus of Vase Shaped Microfossils (VSM) have been recorded from the intercalated shales in limestone of Charmuria exposed in and around Kutela village of Raigarh district. A rich and diverse assemblage comprising 27 genera (16 acritarchs, 10 algae genera and single VSM) has also been yielded from the shales of Gundardehi exposed in and around Dhobinipali village of Raigarh district.

The cyanobacterial remains represent solitary and colonies of sphaeroidal cells and unbranched trichomes both septate/aseptate with/without mucilaginous sheath resembles with the extant forms belonging to Cyanophyta and Chlorophyta. The recovered acritarchs are sphaeromorphs (simple and ornamented in nature) followed by acanthomorphs (spinated) belonging to

Sphaeromorphida and Sphaerohystrichomorphida, Fusomorphida and Versimorphida subgroups. The Chhuipali shale has yielded low density and good preservation of microbiotic assemblage. The appreciated frequency of algal remains with distorted low frequency of acritarchs in Charmuria and high frequency of acritarchs with low frequency of algal remains in Gundardehi formations is recorded in the present microbiotic assemblage. The distorted acritarchs in Charmuria Formation are due to either limestone auto-generation heat or fault near the area due to geodynamic activities, while good preservation of acritarchs and fewer amounts of algae in Gundardehi Formation rather Chhuipali Formation represent moderate deeper environments. The preliminary studies of recorded biotic communities from the Chhuipali Formation and both formations of Raipur Group show an evolutionary trend ranges from Latest Calymian to Cryogenian age in ascending order and two types of environmental setting for these deposits. This incredible finding is closely resembled with known assemblages of the equivalent sediments with China and Australia and central Ural. A paper on carbonaceous remains from the Saraipali Formation of Singhora Group has been finalized.

In addition, visited total 25 localities in and around Sarangarh and adjoining areas of Raigarh district for the collection of palynological samples (shales, siltstones and cherts), stromatolites, trace fossils and carbonaceous mega-remains preserved on the bedding plane of the shales and limestones belonging to Singhora, Chandarpur and Raipur groups of Chhattisgarh Supergroup. Some geological information of the areas is also added.

Rupendra Babu & V.K. Singh

Thrust Area : FOSSIL LAND PLANT COMMUNITIES: MORPHO-STRUCTURE, EVOLUTION, SYSTEMATICS WITH APPLICATIONS TO BIO-STRATIGRAPHY AND PALAEOECOLOGY (Plant evolution, anatomy, taxonomy and stratigraphy)

Gondwana-Mesozoic Palaeofloristics Group

Project 2.1: Palaeobotanical investigation of Satpura Gondwana Basin to analyze the floristic succession, evolutionary perspective, biostratigraphy and palaeoenvironment.

The plant fossils collected from different localities of Pench Valley, Kanhan Valley, Pathakhera and Mohpani coalfields have been described. Morphotaxonomical

analysis, photodocumentation, comparison and stratigraphical significance of the flora are under progress. Plant fossil assemblage of Pench Valley Coalfield is

represented by species of *Glossopteris*, *Gangamopteris*, *Noeggerathiopsis*, *Euryphyllum*, *Ottokaria*, *Arberia*, *Arberiella*, *Phyllotheca*, *Buriadia*, *Vertebraria*, variety of seeds, seed-bearing organs, ribbed and simple axes. It has been observed that the leaves of *Gangamopteris* are dominant in the assemblage. The recorded species are— *G. cyclopteroides*, *G. major*, *G. angustifolia*, *G. kashmirensis*, *G. karharbariensis*, *G. gondwanensis*, *G. hughesii*, *G. fibrosa*, *G. clarkeana*, *G. buriadica*, *G. mucronata*, *G. intermedia*, *G. spathulata* and *G. obliqua*. The morphological study of the specimens indicates the presence of two new species of *Gangamopteris*, *G. sethiaensis* sp. nov. and *G. satpuraensis* sp. nov. The specimens of *Glossopteris* are known by *G. indica*, *G. communis*, *G. karanpurensis*, *G. nimishea*, *G. intermittens*, *G. subtilis*, *G. angusta*, *G. arberii*, *G. churiensis*, *G. decipiens*, *G. zeilleri*, *G. longicaulis*, *G. tenuifolia*, *G. gigas*, *G. stricta* and *G. nakkarea*.

Study of the plant fossils of Kanhan Valley Coalfield shows the presence of species of *Glossopteris*, *Gangamopteris*, *Noeggerathiopsis*, *Buriadia*, different types of seeds and equisetalean axes. *Gangamopteris* species are represented by *G. cyclopteroides*, *G. angustifolia*, *G. major*, *G. karharbariensis*, *G. gondwanensis*, *G. fibrosa* while the *Glossopteris* species are represented *G. indica*, *G. communis*, *G. angustifolia*, *G. browniana* and *G. angusta*. Morphotaxonomical analysis, photodocumentation and comparison of the flora are completed.

The observation of plant fossils of Pathakhera area shows the dominance of *Gangamopteris*-*Noeggerathiopsis* leaves and variety of seeds, e.g. *Samaropsis*, *Cordaicarpus*, *Cornucarpus*, *Alatocarpus* and bunch of seeds. The taxonomical identification and comparison of the plant fossils are under progress. The plant fossils of Mohpani area are mainly studied from the sections exposed in Sitarewa river near the villages Mohpani and Nayakheda. The assemblage is known by the species of *Gangamopteris*, *Glossopteris*, *Buriadia*, *Arberia* and dispersed seeds. The detail analysis of flora is under progress.

The type and figured specimens preserved at the museum of GSI and Indian Museum, Kolkata are examined (during August 2-11, 2009). The morphological features of the specimens have been critically studied to understand the shape, size, venation pattern, fertile features and distinguishing characters of Lower Gondwana plant fossils. During the period 145 specimens belonging to different species of *Glossopteris*,

Gangamopteris, *Noeggerathiopsis*, *Taeniopteris*, *Macrotaeniopteris*, *Psymphyllum*, *Rhipidopsis*, *Sagenopteris*, *Pseudecten*, *Araucarites*, *Sphenophyllum*, *Trizygia*, *Merianopteris*, *Sphenopteris*, *Pecopteris*, *Cyathia*, *Barakaria*, *Alethopteris*, *Dicksonia*, *Ottokaria*, *Poacites*, *Dictyopteridium*, *Voltzia*, *Buriadia*, *Bothrodendron*, *Cordaites*, *Phyllotheca*, *Schizoneura*, *Vertebraria* and *Albertia* have been examined and photographed. The study is helpful in identification and comparison of plant fossils of Satpura Gondwana Basin.

A.K. Srivastava & Deepa Agnihotri

Plant fossils recovered from Gotitoria open cast project of Mohpani Coalfield have been sorted out, grouped and processed for investigation. Observation, description, taxonomic identification and comparison of the flora are under progress.

A.K. Srivastava & Anju Saxena

Trace fossils and insect burrows collected from Barakar and Bijori formations of Mohpani and Pench Valley coalfields are studied. The trace fossils are comparable with *Palaeophycus tubularis* and *Planolites beverleyensis*. Insect burrows are found in association with the elements of *Glossopteris* flora viz., *Glossopteris*, *Neomariopteris*, *Santhalea*, *Cordaicarpus*, *Vertebraria* and equisetalean axes. They are very characteristic in having the infilling of host rock and their exit point is markedly swollen with a distinct hole. Presence of circular depression indicates the concealment of burrows.

A.K. Srivastava, Anju Saxena & Deepa Agnihotri

Systematic morphotaxonomical description, identification, photodocumentation and comparison of plant fossil assemblages collected from Rawanwara Area of Pench Valley Coalfield viz., Rawanwara OCP, Rawanwara Khas OCP, Pench East and Rawanwara underground mine (Pit-3) have been carried out. Fossils are mainly preserved in carbonaceous shales overlying and underlying the coalbeds. The samples belong to Lower Barakar coal seams (Nos. IV and V). The plant fossil assemblage comprises 11 genera and 37 species. Genus *Gangamopteris* includes 3 species— *G. angustifolia*, *G. clarkeana* and *G. cyclopteroides*. The genus *Glossopteris* is dominant in the assemblage and it is known by *G. ampla*, *G. angustifolia*, *G. arberii*, *G. sp.cf.* *G. barakarensis*, *G. browniana*, *G. communis*, *G. fibrosa*, *G. giridihensis*, *G. indica*, *G. karanpurensis*, *G. leptoneura*, *G. longicaulis*, *G. mohudaensis*, *G. musaefolia*, *G. nimishea*, *G. recurva*, *G. spathulata*, *G.*

subtilis, *G. syaldiensis*, *G. tenuifolia* and *G. vulgaris*. The leaves of *Noeggerathiopsis*, *Cordaites*, *Cheirophyllum* and foliage axis of *Buriadia* are known by single species, *N. hislopii*, *Cordaites* sp., *Cheirophyllum lacerata* and *Buriadia heterophylla*. Seeds discovered are described under 4 genera viz., *Cordaicarpus* with 3 species (*C. chichariensis*, *C.*

karharbarensis, *C. zeilleri*), *Cornucarpus furcata*, *Samaropsis ganjrensis*, *S. goraiensis*, *S. penchii* sp. nov. and *Alatocarpus indicus*. Floristically assemblages are comparable with the flora of Karharbari Formation of Giridih, Auranga and South Rewa Gondwana Basin. The work has been compiled in the form of a Ph. D. Thesis.

A.K. Srivastava & S.S.K. Pillai

Project 2.3: Morphotaxonomy, floristics, biostratigraphy and palaeoecological studies in Hasdev and Chirimiri areas (Son-Mahanadi Basin)

Hundred twenty-five specimens of megafossils collected in 2008 from the Rajnagar and Kurasia collieries of Hasdev and Chirimiri areas, Korea district (Chhattisgarh) are cleared, identified and studied. Thirty five of them are photographed. The assemblage from Rajnagar-F colliery consists of *Gangamopteris* sp., seeds, Scale leaves, equisetalean stems, stem impressions, and

4 species of *Glossopteris* viz., *G. communis*, *G. indica*, *G. tenuifolia* and *G. gigas*. The assemblage from Kurasia colliery includes *Gangamopteris* sp., *G. cyclopteroides*, *G. angustifolia*, *Glossopteris* sp., *G. communis*, *Noeggerathiopsis hislopi*, *Cardaicarpus* seeds, *Samaropsis* sp. and equisetalean stems.

K.J. Singh

Project 2.4: Palaeofloral diversity, biostratigraphy and palaeoecological study during Mesozoic in South Rewa Basin, Madhya Pradesh

The flora recovered from Praghua and Khareri in South Rewa Basin has been studied to understand the palaeovegetation in time and space. Although, plant fossils are not well-preserved as they are found comparatively in fragmentary state than other fossil localities of the basin. The genera recorded— *?Equisetites*, *Cladophlebis*, proliferation of *Gleichenia* twigs, Stem axis, *Elatocladus*, *Pagiophyllum* and *Brachyphyllum*, are compared and

correlated with various Early Cretaceous palaeofloral assemblages of India. It is observed that the flora of the area is coeval with the flora of Dhrangadra and Himmatnagar formations of Saurashtra, which shows dominance of conifers and pteridophytes and absence of cycadophytes. Also undertook field work for collection of plant fossils from Patparha, Dhindhori, Taken, Barambaba, etc areas of the basin in Madhya Pradesh.

Neeru Prakash

Project 2.5: Palaeofloristical analysis of Mesozoic sedimentary succession of western India

Compiled the megafloral assemblage, consisting of fossil algal mats, *Thallites*, *Coniopteris*, *Onychiopsis*,

Brachyphyllum, etc., recovered from the *Isoetites*-rich locality near Than (Gujarat).

B.N. Jana (superannuated w.e.f. 30.06.2009)

Project 2.6: Integrated Palaeobiology of East Coast Cretaceous

Studied plant fossil collections of the Raghavapuram Formation and probable angiosperm fossils are identified. Recovery of dissected leaf material and fruit material along with bivalves suggests an aquatic fresh water environment. Palaeoecological studies on Early Cretaceous wood fossils of Krishna-Godavari Basin indicate existence of araucarian and podocarpacean forests in the vicinity of deposition. Extensive occurrence of leaf fossils from the Gangapur Formation, Pranhita-

Godavari Basin and their affinity to pteridophytic and gymnospermous plant groups helped to infer a fluvial set up in the studied area. In addition, field excursion to East Coast sedimentary basins— K-G and P-G basins has been undertaken and collected a number of sediments and specimens in the form of impressions, compressions and petrifications from various localities for analysis.

A. Rajanikanth



Project 2.7: Investigation of carbonified/ fusainised plant mesofossils recovered through bulk maceration of Late Triassic and Tertiary sediments of India and comparative studies on selected modern taxa

Cuticle isolated from plant compressions on hand specimens collected from the Nidhpuri plant-bearing bed has been investigated and described in some details. The species so studied have been assigned to several taxa of fossil foliage, such as *Lepidopteris*, *Dicroidium* and *Glossopteris*, and some fertile organs and associated parts like trichomes. Presence of trichomes has not from outer surface layers of plant cells. Trichomes can be permanent or temporary fixtures breaking apart or falling off over time. Trichomes can be taxonomically useful as they are unique for most taxa. In fossil cuticles the trichomes are rarely preserved. Their presence is usually surmised from the trichome bases, as the trichomes are

shed during the life of the leaf, decay, or do not survive oxidative maceration. Intact trichomes have been observed only on a few pieces of cuticle, but their presence is sometimes marked by pore-like structures. Trichomes are tall or short, thin or thick, and big or tiny. Some of the trichomes are thickened at the base while others have a large bulb-like swelling at the distal end. During the study, reported diverse forms of trichomes adorning 'upper' cuticle of a pedicellate, lobed pinnule. Cuticle of none of the megafossil taxa so far reported from the Nidhpuri plant-bearing beds has been shown to possess trichomes or even trichome-bases.

Usha Bajpai

Gondwana Palynology Group

Project 3.1: Palynostratigraphy and evolution of palynoflora through the Palaeozoic and Mesozoic sequence in Rajmahal Basin

Compiled the palynological data generated from coal-bearing horizon encountered in 10 bore-holes of the Rajmahal Basin. The study evidenced definite Late

Permian age for part of coal-bearing strata in the basin, along with the coal seams of Early Permian Barakar Formation.

Archana Tripathi (superannuated w.e.f. 31.07.2009)

Project 3.2: Palynostratigraphy of Late Palaeozoic and Mesozoic sequence in Singrauli and Tatapani-Ramkola coalfields and adjacent areas in Madhya Pradesh

Continued palynological studies on the samples from bore-holes SMBS-1 (Singrauli Coalfield) and TRBD-2

(Tatpani-Ramkola Coalfield). Palynodating suggests Early Permian (Barakar Formation) age.

Archana Tripathi (superannuated w.e.f. 31.07.2009) & Vijaya

Project 3.3: Palynostratigraphy and palaeoclimatic studies on Gondwana sediments of Sohagpur and Mand Raigarh coalfields

Samples from 3 bore-holes: SSL-2 (depth 9.40-214.50 m), SSL-4 (73.00-299.10 m) and SNB-1 (20.65-1300 m) of Sohagpur Coalfield have been analysed to understand the distribution of palynoflora. In SSL-2, two palynozones have been identified. The older palynozone (depth 142.70- 214.50 m) has dominance of *Scheuringipollenites* in association with *Indotriradites*, *Dentatispora*, *Faunipollenites* and *Striatopodocarpites*, indicating Early Permian age to the assemblage. The younger palynozone (9.40-134.45 m)

has dominance of striated bisaccate pollen (*Faunipollenites*, *Striatopodocarpites* and *Crescentipollenites*) indicating Late Permian age to the assemblage. In SSL-4, two palynozones have been identified– Late Talchir palynoflora between 260.50-299.10 m depth, and Lower Barakar palynoflora (*Scheuringipollenites barakarensis* palynozone) between 203.60-73.00 m. The palynological analysis of SNB-1 (~1300 m thick strata) has revealed the dominance of non-striate disaccate pollen (*Falcisporites*,

Klausipollenites, *Nidipollenites* and *Satsangisaccites*) followed by cavate, cingulated and zonate forms; showing Triassic age to the assemblage. Besides, a number of ornamented tetrads assignable to form genera *Densoisporites*, *Lundbladispota*, *Decisporites* and *Lapposisporites* has also been recorded between 907.00-1075.15 m depth; suggesting that a warm humid climate

was prevailing during Triassic period in the western part of south Rewa Basin. In one sample (SNB-1/61, 787.50m depth) well-preserved dinoflagellate cysts have also been observed. Also undertook field work for the collection of outcrop samples from Sohagpur and Mand-Raigarh coalfields.

RamAwatar

Project 3.4: Morphotaxonomy, floristics, evolution, biostratigraphy and palaeoenvironmental studies of Ib-River Coalfield (Orissa)

Recovered two palynoassemblages from surface samples collected from Naupura and Banjari Nala section and from Lilahari Nala section Kuraly block-A. The Palynoassemblage-1 has the dominance of *Faunipollenites* and subdominance of *Scheuringipollenites* along with the presence of *Striatopollenites*, *Verticipollenites*, *Rhizomaspora*, *Ibisporites*, *Cyclogranisporites*, *Cyclobaculispora* and *Ephedripites*, etc.; showing the affinities with upper Barakar palynoflora of late Early Permian age. The palynoassemblage-II recovered from samples of Banjari has the dominance of *Striatopodocarpites* and subdominance of *Faunipollites* in the presence of *Diastrates*, *Distrimonosaccites*, *Cyclogranisporites*, *Microbaculispora*, *Parasaccites*, *Ephedripites*, *Inaperturopollenites*, *Callumspora*, *Densipollenites magnicarpus*, *Rhizomophora*, *Verticipollenites*, *Navelesporites*, *Striatites*,

Striamonosaccites, *Diastriamonosaccites*, *Leiotriletes* and *Lophotrilites*. The appearance of *Arcuatipollenites*, *Densoisporites*, *Lundbladispota*, etc. along with the presence of *D. magnicarpus* shows the younger affinities to Late Permian age equal to upper Raniganj palynoflora. Similar palynoassemblage has already been recovered from the borehole IBSK-I of the coalfield.

The studies of samples from bore-holes IBKN-5 and IBKN-6 are continued. The recovered flora shows the affinity with upper Barakar age and Late Permian age. Besides, the Raniganj sediments may be overlain by Middle to Late Triassic sediments. In addition, visited Ib-Himgir Basin Coalfield (Jharsuguda and Sundargarh districts) and collected sub-surface and surface samples for palynological studies.

K.L.Meena

Project 3.5: Palynostratigraphy and patterns of evolution in palynoflora in Damodar Basin

In bore-hole RRK-1 drilled near Rakshitpur (Raniganj Coalfield), the lithounits identified between 115 and 610 m are in unconformable contact with each other. Tertiary sediments (115-179.70 m) that contain *Callialasporites*, *Araucariacites*, *Podocarpidites*, etc. show continuity with the underlying supra-trappean strata (179.70-185.70 m). Two palynozones have been identified within the Rajmahal Formation (*Foraminisporis asymmetricus*: 179.70-185.70 m, and *Foraminisporis wonthaggiensis*: 198.92-216.63 m); suggesting Valanginian to Barremian age. The chocolate facies of the Panchet Formation (253.70-471.70 m) is devoid of palyniferous matter except at 260.55 m depth, where the *Foraminisporis wonthaggiensis* assemblage of the younger horizon (inter-trappean) continues to occur. Downwards, between 261.20 and 262.40 m depth,

Permian taxa *Striatopodocarpites*, *Faunipollenites*, and *Densipollenites* are abundant, but *Arcuatipollenites pellucidus*, *Playfordiaspora cancellosa*, and *Goubinispora indica* are rare. Besides, *Callialasporites turbatus/C. microvelatus*, first occurred at 262.40 m depth, are still present in the Panchet Formation. This kind of mixed population of palynomorphs is suggestive of disturbed zone in the deposit, and had happened at the on-set of volcanic activity in the study area, and re-defines the status of this part (253.70-262.40 m) to be infra-trappean. Occurrence of pebble bed at 262.40-262.80 m further supplements this hiatus. In the coal-bearing horizon (471.70-610.00 m), two identified palynoassemblages, *Densipollenites magnicarpus* and *Gondisporites raniganjensis*, indicate Late Permian age for this part of the Raniganj Formation. Abundant wood

shreads, plant tissues in the chocolate facies of the Panchet Formation and at intervals in the coal horizon suggest high-energy flow during sedimentation in the study area.

The study of Upper Palaeozoic and Mesozoic palynomorphs in 3 borecores from the Deocha-Pachami area, Birbhum Coalfield has allowed dating of the Talchir, Barakar, Dubrajpur and Rajmahal formations, and revealed many hiatuses. The lower most unit (Talchir Formation) yielded earliest Permian palynomorphs. The Barakar Formation, which includes coal-bearing strata, was previously dated as Early Permian. However, data presented herein indicate an Early Permian to earliest Triassic age for this unit, containing actually the Karharbari, Barakar, Kulti and Raniganj formations as well as the basal part of the Panchet Formation. The overlying Dubrajpur Formation is Jurassic (Callovian to Tithonian) in age, with an unconformity at its base. The upper most Dubrajpur Formation is Tithonian-Berriasian. The palynomorphs from the intertrappeans within the Rajmahal Formation suggest an Early Cretaceous age. The revised ages of the Barakar and Dubrajpur formations are of major regional significance. The distribution pattern of spore-pollen may provide a broad spectrum of palaeoclimate during Permian, Late Jurassic, and Early Cretaceous times, as there is no record of marine signature in the study area.

Vijaya

The palynological assemblages recovered from the coal horizon and Mesozoic succession, encountered in two bore-holes BRM-2 and BGG-3 of Birbhum Coalfield, have been studied for their age interpretation. Four palynoassemblages are identified in the Barakar Formation (271.45-527.50 m, BRM-2) of the Late Permian age. Dubrajpur Formation (315.00-334.90 m, BGG-3; 237.75-271.45 m, BRM-2) has yielded *Contignisporites cooksoniae* and *Cicatricosisporites australiensis* palynozone, which are suggestive of Middle Jurassic and earliest Cretaceous (Berriasian) age. The overlying Infratrappean (214.90-237.75 m) and the Intertrappean (154.50-156.90 m) sediments of the Rajmahal Formation in bore-hole BRM-2, contain *Foraminisporis wonthaggiensis* palynozone that dates Valanginian to Hauterivian in age. While in bore-hole BGG-3, the Intertrappean strata (174.60-242.60 m) has proved devoid of spore-pollen.

Borehole EBM-1 (13.00-1198.30 m depth) in Muditoli block, eastern part of the East Bokaro Coalfield, is worked-out for its spore-pollen content. In this litho succession, on the basis of age marker taxa, 7 palynozone have been identified. Between 1198.30 and 1095.25 m depth, the specimens are very dark brown with distorted exinal surface. Presence of radial monosaccate pollen taxa infers this strata to the Talchir Formation of Early Permian. In the up-section, an abundance of *Faunipollenites*, *Scheuringipollenites*, *Densipollenites* and *Striatopodocarpites* is observed. The relative abundance of these taxa delimits varied levels in the palynosequence of the studied strata (1086.95-13.00 m). Hence, it is inferred that these deposits contain the representative palynoassemblages of Early to Late Permian in age. The FAD's of *Lundbladispora microconata*, *Playfordiaspora cancellosa* and *Arcuatipollenites pellucidus* observed at 13.00, 51.50, 66.70 m depths enhance the end Permian level, as these elements are the key species to mark transition of Permian into the Lower Triassic.

Vijaya & Srikanta Murthy

The samples from borecore RT-4 (approx. 547.00 m thick) of Tamra Block, Raniganj Coalfield are analyzed palynologically. On the basis of distribution pattern of palynomorphs and the age marker taxa, 2 assemblage zones are identified. In the Barren Measures Formation, dominance of enveloping monosaccate (*Densipollenites*) along with striate bisaccate (*Striatopodocarpites*, *Faunipollenites*) pollen taxa and equates this (30.75-227.80 m depth) strata with the Raniganj Formation of Late Permian in age. Between 423.80 and 577.70 m depth, as abundance of non-striate (*Scheuringipollenites*) and striate bisaccate pollen taxa (*Faunipollenites* and *Striatopodocarpites*) are observed within the Barakar Formation of late Early Permian age. Fair occurrence of hyaline, distorted and blackish-brown plant matter is observed within 231.00 to 408.40 m depth. Present study evidences the existence of the coal horizon in the Barren Measures in the study area, and unproductive strata might represent the part of the Barren Measures Formation. Besides, visited Pench Valley Coalfield and around Chhindwara district, Satpura Basin (Madhya Pradesh) for collection of palynological samples.

Srikanta Murthy

Cenozoic Palaeofloristics Group

Project 4.1: Tertiary floristics of Rajasthan and Gujarat

Over 100 petrified woods from the Tertiary sediments of Jaisalmer district of Rajasthan and Bhavnagar and Kutch, districts of Gujarat have been cut and studied. The investigation of the woods has revealed occurrence of the genera— *Bauhinia*, *Cordia*, *Cynometra*, *Dillenia*, *Dracontomelum*, *Eucalyptus*, *Ficus*, *Lagerstroemia*, *Laurinoxylon*, *Millettia-Pongamia*, *Shorea*, *Terminalia* and *Tristania*. These genera represent the following families— Anacardiaceae, Fabaceae, Boraginaceae, Combretaceae, Dilleniaceae, Dipterocarpaceae, Moraceae, Lythraceae, Lauraceae, and Myrtaceae. In addition, a large number of leaf-impressions from Kutch district, and Barmer and Bikaner districts of Rajasthan have been studied. The genera identified are— *Anthocephalus*, *Artocarpus*, *Calophyllum*, *Diospyros*, *Eucalyptus*, *Garcinia*,

Glochidion, *Kleinhovia*, *Mesua*, *Myristica*, *Semecarpus*, *Shorea* (fruit wing), *Sterculia* and *Syzygium* and they represent the families— Anacardiaceae, Clusiaceae, Dipterocarpaceae, Ebenaceae, Euphorbiaceae, Moraceae, Myristicaceae, Myrtaceae, and Sterculiaceae.

Visited Central National Herbarium, Howrah for identification of the fossil leaf and fruit material. A number of fossil specimens were identified on detailed comparison with modern herbarium materials. Also visited Wood Anatomy Branch of the Forest Research Institute, Dehradun for comparison and confirmation of identification of the fossil woods. Identification of a number of wood genera was confirmed.

J.S. Guleria & Anumeha Shukla

Project 4.2: Floristics (Megafossil) of Deccan Intertrappean beds of India

Investigated angiospermous fossil woods from Jhargad near Jhadgaon village in Yavatmal district (Maharashtra). Dicotyledonous woods have been identified as *Ailanthoxylon indicum* (Simarubaceae) and *Barringtonioxylon deccanense* (Lecythidaceae). Both

the genera are recorded from a number of Deccan Intertrappean localities. A number of palm woods are also recorded. The presence of the genus *Barringtonia* along with number of palms indicates the existence of tropical moist and swampy conditions in the central India.

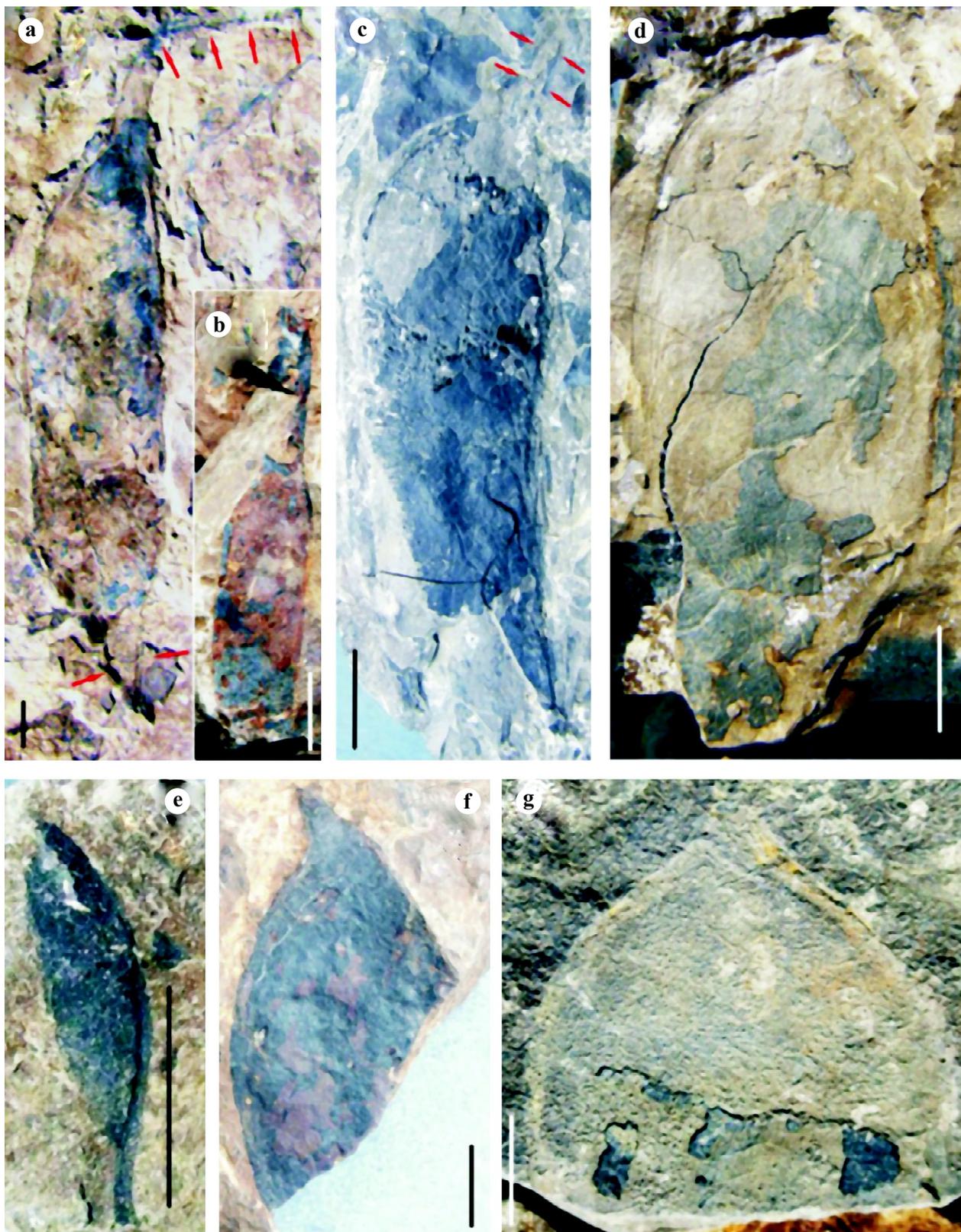
Rashmi Srivastava

Project 4.3: Cenozoic floral changes in northeast India vis-à-vis movement of the Indian Plate

About 30 fossil woods, collected from the Tipam Sandstone Formation of North Lakhimpur and Dhima districts of Assam, have been studied in detail and photographed. About seven of them are new from there belonging to Anacardiaceae, Bischofiaceae and Fabaceae families. A number of fossil leaves collected from the Oligocene sequence of the Makum Coalfield (Assam) have also been identified. They

belong to Annonaceae, Clusiaceae, Apocynaceae, Anacardiaceae, Meliaceae, Lauraceae, Sterculiaceae, Euphorbiaceae, Rhizophoraceae and Arecaceae families. Their further study is under progress. In addition, a large number of leaves and a few fruits and flowers are collected from the Late Palaeocene sediments of Nangalbira, Meghalaya. They have been cleared for further study.

R.C. Mehrotra



a & c. *Leguminocarpon dilcheri* sp. nov. – Fossil fruits showing veinlets, a beak like structure at the ends and long pedicel (marked by arrows); **b.** *L. tirapensis* sp. nov. – A fossil fruit; **d.** *L. baragolaiensis* sp. nov.- Fossil fruit showing shape, size and horizontal and oblique veinlets; **e.** *L. lakhanpalii* sp. nov. - A very small fruit showing a long stalk; **f.** *Buteocarpon oligocenicum* gen. et sp. nov. - Fossil showing attenuate apex and oblique veinlets; **g.** *Leguminocarpon* sp. g. A fragmentary specimen of the fossil fruit showing acute apex. (Bar scale = 1 cm)

Project 4.4: Tertiary floristics of South India

Compiled data on plant megafossils (carbonized woods, petrified woods, leaves, fruits, seeds) recovered from Neyveli (Tamil Nadu), Ratnagiri (Maharashtra),

Bahur Basin (Pondicherry), and Cochin, Cannanore, Payangadi and Warkala (Kerala).

Anil Agarwal (superannuated w.e.f. 31.07.2009)

Project 4.5 : Study on Tertiary plant megafossils of north-west Himalaya

A large area has been surveyed and examined for megafossil remains in the sediments of Dharamsala Formation around Dharamsala and nearby areas of Himachal Pradesh. In addition, explored some of the Siwalik sediments near Kangra, Kotla and around Nurpur for the plant fossils. Fossil impressions were meager and ill preserved. A large area has also been explored for the collection of plant fossils at Kasauli and adjoining areas of Solan district. The sediments of Kasauli Formation (Lower Miocene) are the thickest Tertiary sediments in the Kasauli area. A number of well preserved leaf impressions are collected from MES Water Tank area

preserved in greenish grey hard shales and siltstones. No fossil wood is encountered in the area except some wood casts are observed in sediments near Dharampur (at 'Kheel ka mod'). Similar wood casts are also observed in Dharamsala sediments near Kareri village. For the first time, leaf impressions are collected from road section near Mohri village (30°56'19.2":77°00'39.2"; elevation 1446 m) near Subathu. The specimens have been cleared. A few leaves are tentatively identified as *Amesoneuron* (Arecaceae), *Ficus* (Moraceae), *Syzigium* (Myrtaceae), and *Terminalia* (Combretaceae).

J.S. Guleria & Rashmi Srivastava

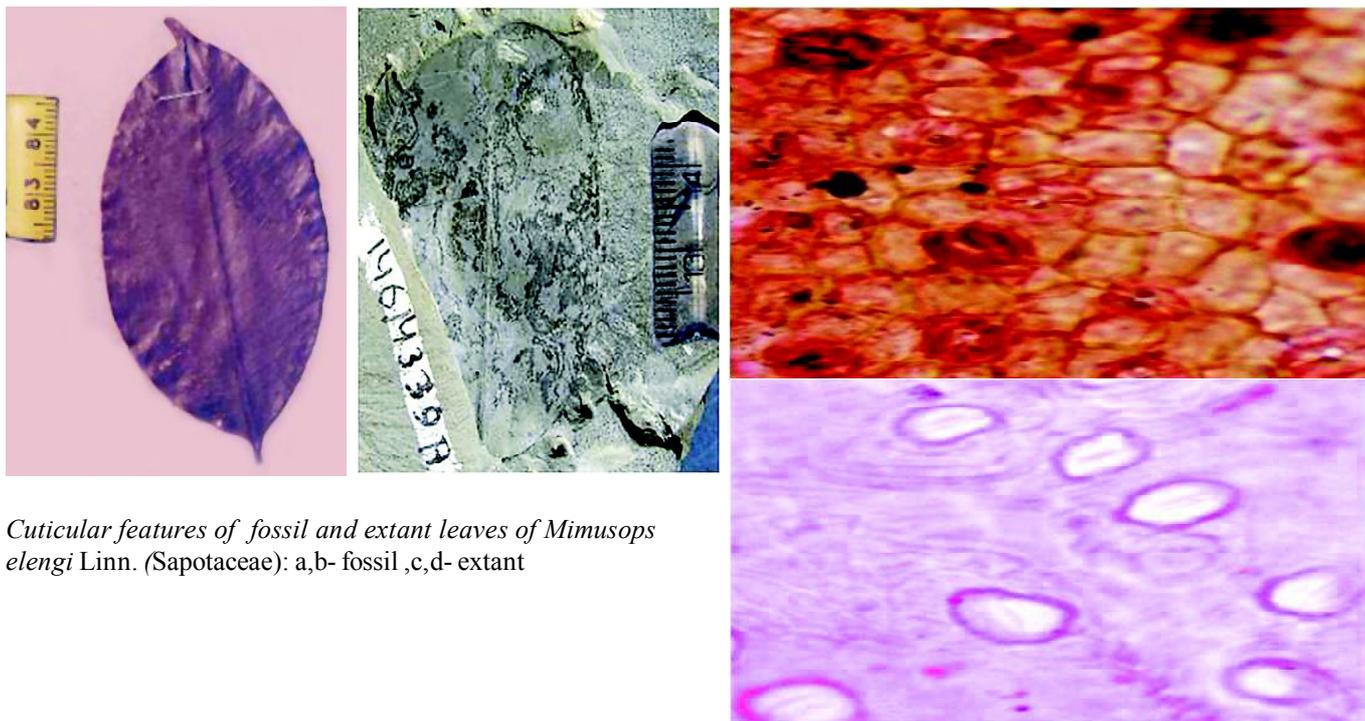
Project 4.6: Sub-Himalayan floral diversity and its palaeoclimatic and stratigraphic implications

Investigated the fossil leaf assemblage collected for the first time from about 1 km from Markande Bridge on Vikrambag Road, Nahan area, Himachal Pradesh. The morphological study of the leaf assemblage reveals the occurrence of four taxa viz., *Artabotrys zelanicus* Hook. f., *Fissistigma wallichii* Hook. f. (Anonaceae), *Dipterocarpus turbinatus* (Dipterocarpaceae) and *Peltophorum* sp. (Fabaceae). The habit and habitat of these taxa suggest that a tropical moist deciduous to evergreen forest was flourishing in the Nahan area during Middle Miocene period. Also investigated petrified fossil woods from Siwalik sediments exposed near Tanakpur in Champawat district, Uttarakhand. Out of several fossil woods, only a fossil wood has been identified with new taxa, *Bischofia javanica* Bl. of the family Euphorbiaceae. This finding is reported for the first time from the Siwalik sediments and belonging to Indo-Malayan region.

The cuticle bearing fossil leaves have been studied and identified on the basis of both morphological and cuticular features (epidermal cells, stomatal density, stomatal index, etc). They resemble closely with the extant taxa, *Hydnocarpus pentandra* (Flacourtiaceae), *Pterospermum acerifolium* (Sterculiaceae), *Dichapetalum gelonioides* (Dichapetalaceae), *Paranephephelium macrophyllum* and *P. xanthophyllum* (Sapindaceae), *Gluta renghas* (Anacardiaceae) and *Mimusops elengi* (Sapotaceae). The

habit, habitat and present day distribution of the above modern comparable taxa suggest the prevalence of warm humid climate during deposition of Siwalik sediments in the sub-Himalayan zone.

Analyzed the palaeobotanical data based on the leaf assemblage from the Middle Miocene sediments of Koilabas area, western Nepal in order to deduce the palaeoclimate. The nearest living relative method indicates that the fossil assemblage is overall dominated by trees of 88 species suggesting the luxuriant growth of terrestrial plant around the fossil locality. The present day distribution of the modern comparable taxa of the fossil leaves shows that some of them are not found at present in the Himalayan foot hills of Nepal most probably due to prevalence of unfavorable conditions. Of these, most of the taxa are migrated towards other phytogeographical regions where favorable climatic condition exists. The overall floral assemblage consists of three major types of elements– i) evergreen, ii) evergreen and moist deciduous, and iii) mixed deciduous. The evergreen elements dominate the fossil flora of Koilabas area during Middle Miocene period in contrast to mixed deciduous vegetation occurring today in the area. Thus, it may be suggested that a warm and humid climate was prevailed in this area of Himalayan foot hills at the time of sedimentation instead of relatively dry climate at present. The physiognomic



Cuticular features of fossil and extant leaves of *Mimosa elengi* Linn. (Sapotaceae): a,b- fossil ,c,d- extant

features that have been used mainly for determining climates are leaf margin, drip tips, leaf size and venation pattern. The analysis of the Koilabas leaf assemblage shows that there are only four taxa which possess non-entire margin. The leaf margin analysis (LMA), which is based on established positive relationship between the percentage of woody species in the floral assemblage with entire margined leaves and temperature, suggests the MAT (Mean Annual Temperature) value 30.6° for the fossil leaf flora of the area. This value is higher than the current value of the region. Similarly, the Mean Annual Precipitation (MAP) has also been calculated based on the proportion of large leaves in the assemblage. It gives the MAP value 356 mm for the present assemblage. This MAP value is also higher than the estimated average MAP value of the whole Himalayan foot hills as well as current MAP value of Koilabas area. Thus, it may be surmised

that Koilabas flora flourished under warm humid climate with greater value of MAT and MAP than the current values of the region.

Undertook a field excursion to the Siwalik of Tanakpur and near by area in Uttarakhand and collected a large number of plant fossils (petrified woods, leaf and fruit impressions) and some palynological samples for investigation. Also consulted Central National Herbarium, Howrah for the identification of plant megafossils collected from different Siwalik fossil localities of India and Nepal. More than 35 leaf impressions and a fruit have been identified. The photographs of leaf and fruit specimens of about 30 species of the genus *Hopea* Roxb. of the family Dipterocarpaceae have been taken in order to differentiate them on the basis of morphological and cuticular features.

Mahesh Prasad

Late Mesozoic-Cenozoic Palynology Group

Project 5.1: Palynological investigation of Tertiary sediments of Kutch Basin: biostratigraphic and palaeoenvironmental applications

The study of palynoassemblage recorded from the Intertrappean bed exposed near Naredi, western Kutch (Gujarat) has been finalized. Palynofloral study of the Naredi Formation exposed near Naredi village and Madhwali Nadi near Matanomadh is being done. The

presence of dinoflagellate cysts along with the terrestrial floral assemblage in some samples from Madhwali Nadi indicates marine transgressive phases under warm, tropical climatic conditions. Study of the fossil insects recovered from the Intertrappean bed and Gypseous Shale



Member of the Naredi Formation is also being carried out. Maceration and slide preparation of samples collected from the Matanomadh lignite mine (near Matanomadh) and Intertrappean bed (exposed at Kora village) have been completed and the study of palynofloral assemblage is in progress. The presence of dinoflagellate cysts also, in some samples from Matanomadh lignite mine, indicates

the transgressive phases of the sea that can be correlated with the Madhwali Nadi section. In addition, carried out field work in Kutch district (by RKS) and collected 105 samples from 14 localities belonging to various Tertiary formations, exposed in western Kutch. Surface samples are also collected from a number of localities.

R.K. Saxena & P.S. Ranhotra

Project 5.2: Palynological investigation, facies analysis and palaeoenvironmental interpretations of Palaeocene-Eocene sediments in Rajasthan Basin

Detailed morphotaxonomic studies on palynofossils recovered from a sequence representing the base of Nagaur Group, Nagaur has been done. The succession, recognized as Marh Formation, is about 16 m thick and is constituted by carbonaceous shale, siltstone and lignite. Shale and lignite samples yielded a rich palynological assemblage, which is dominated by angiosperm pollen, particularly those having affinity with the families Meliaceae and Arecaceae. Dominance of these pollen indicates that the chief components of the vegetation cover in the vicinity of depositional site were the plants belonging to these families. Other significant palynotaxa in the assemblage are ascribed to *Lygodiumsporites* spp., *Todisporites* spp., *Lycopodiumsporites* spp., *Dandotiaspora* spp., *Arecipites* spp., *Palmidites* spp., *Longapertites retipilatus*, *Proxapertites* spp. *Matanomadhiasulcites* spp., *Pseudonyssapollenites kutchensis*, *Dermato-*

brevicolporites spp., *Sastripollenites trilobatus*, *Ratariacolporites plicatus* and *Meliapollis* spp.

The palynoassemblage is not closely comparable with that recorded from Barmer. The most abundant arecaceous pollen in Barmer assemblage showing affinity with *Nypa* are registered in very low frequency in Nagaur assemblage. The Bikaner assemblage is also different from the present one as, the former is dominated by arecaceous and other polycolpate/ polycolporate pollen taxa, which are absent in Nagaur assemblage. The early Eocene palynoflora of Kutch Basin is very similar to present assemblage. Many pollen taxa of the families Meliaceae, Bombacaceae and Liliaceae are common to both assemblages. Considering the stratigraphical record of palynofossils in Indian Palaeogene strata, the investigated Nagaur sequence is dated as early Eocene.

S.K.M. Tripathi & Hukam Singh

Project 5.3: High resolution biostratigraphy of Cretaceous-Tertiary sedimentary sections of Cauvery Basin

Carried out laboratory processing of samples (35) collected from Ottakovil, Kallamedu, Kallakudi Mine-II and Niniyur areas of Tamil Nadu. Samples from the Kallamedu and Kallakudi Mine-II are palynologically productive. The significant palynotaxa recovered from the grey marl of Kallakudi Mine-II at Dalmiapuram are *Cyathidites*, *Biretisporites*, *Osmundacidites*, *Verrucosisporites*, *Cicatricosisporites*,

Appendicisporites, *Podocarpidites*, *Callialasporites*, *Spiniferites*, *Oligosphaeridium*, *Cardosphaeridium*, *Ovoidinum*, *Gonyaulacysta* and *Baltisphaeridium*, indicating Lower Cretaceous age. The detailed study is in progress. In addition, documentation of palynological assemblages from Kallamedu and Niniyur areas is continued, besides finalization of data from Periakurichichi Limestone mine.

M.R. Rao

Project 5.4: Palynological studies of the Late Cretaceous-Early Palaeocene sediments of Central India and the Khasi Hills of Meghalaya, India

Deccan Intertrappean beds exposed around Padwar, Jhilimili and Mohgaonkalan of Madhya Pradesh, and Anjar in Gujarat have been chemically processed. The palynological assemblages recovered from the

Deccan intertrappean localities include marker palynotaxa *Mulleripollis bolpurensis* Baksi & Deb, *Ariadnaesporites intermedius* Hall, *Triporoletes reticulatus* (Pocock) Playford, *Gabonisorites*

vigourouxii Boltenhagen, *Azolla cretacea* Stanley and *Aquilapollenites bengalensis* Baksi & Deb; indicating a Maastrichian age for these beds. However, samples from the upper parts of the sections from Anjar area are marked by the presence of *Proxapertites* van der Hammen, *Kielmeyerapollis* Sah & Kar, *Matanomadhiasulcites* Kar and a few pollen genera of advanced angiosperms. This indicates that the deposition continued in the upper most part of the Maastrichian.

Samples of Late Cretaceous samples of Khasi Hills, Meghalaya are also chemically processed. The palynological assemblages are dominated by *Ariadnaesporites intermedius* Hall, *Minerisporites triradiatus* Kar & Singh, *Azolla cretacea* Stanley *Triporoletes reticulatus* (Pocock) Playford, *Appendicisporites problematicus* (Burger) Singh, *A. potomacensis* Brenner, *Cicatricosisporites doregensis* Potonie & Gelletich, *Contignisporites bellus* Kar &

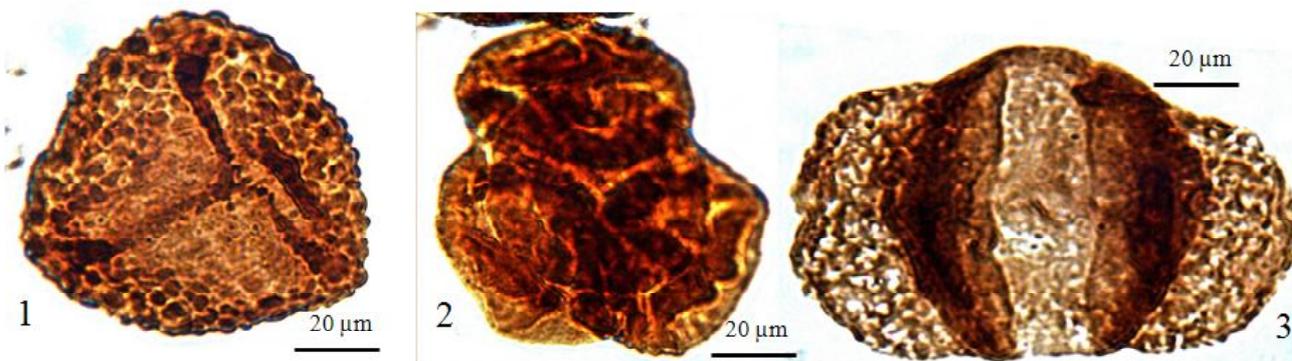
Singh, *C. assamicus* (Singh & Tiwari) Kar & Singh, *Microvoveolatisporites mahadekensis* Kar & Singh, *Araucaricites australis* Cookson, *Palmaepollenites eocenicus* (Biswas) Sah & Dutta, *Liliacidites variegatus* Couper, *Tricolpites archaius* Kar & Singh, *Spinizonocolpites* spp, Normapolles pollen group (*Oculopollis orbicularis*, *Nudopollis* spp., *Krutzschipollis spatiosus*) and fungal remains. The assemblage includes *Azolla cretacea*, *Ariadnaesporites intermedius* and *Triporoletes reticulatus*, indicating a Maastrichian age. Based on the occurrence of elements characteristic of the Northern Hemisphere, viz. 'Normapolles' pollen and *Aquilapollenites* in India, it is speculated that before the actual locking of the two landmasses (Asia and India) occurred, some sort of land connectivity via the island-arc system was already in place, which allowed the northern elements to invade India and establish themselves in Indian peninsula and eastern coast.

R.S. Singh

Project 5.5: Palynofacies analysis and palyno-cyclicity in Palaeogene-Neogene sediments of Upper Assam and Jaintia Hills, northeast India

The palynofacies and palynofloral analysis of various lithotypes— coal, carbonaceous shale, clay and siliciclastic clay, of the coaliferous horizon of Tikak Parbat Formation (Late Oligocene) exposed in mine pit section at Tirap Colliery of Makum coalfields, Upper Assam has been carried out. The recovered palynoflora consist of abundant pteridophytic spores, viz. *Polypodiisporites* spp., *Striatriletes* complex, *Polypodiaceasporites* spp., *Crassoretitriletes vanraadshooveni*, *Cyathidites minor*, *Pteridacidites* sp., *Acrostichumsporites meghalayensis*, and angiosperm pollen, viz. *Palmidites plicatus*, *Palmaepollenites* spp., *Neocouperpollis* sp., *Tricolpites levis*, *T. reticulatus*, *Retitrescolpites africanus*,

Clavaperiporites jacobii along with microthyraeous fruiting bodies and recycled Gondwanic bisaccate pollen grains. The qualitative analysis of palynoassemblage indicates prevalence of swampy condition near the coast under subtropical regime, where large amount of plant derived organic matter from nearby forest along with some eroded material of pre-existing Gondwanic deposits were transported by meandering streams towards the depositional site. Additionally, visited various fossil localities in Upper Assam and Arunachal Pradesh and collected palynological samples from the spot measured sections.



Palynoflora recorded from Tirap Colliery, Tikak Parbat Formation (Chattian), Upper Assam Basin
1. *Acrostichumsporites meghalayensis*, 2. *Corsinipollenites jussiaeensis*, 3. *Falcisporites* sp.



A view of Tikak Parbat Formation (Chattian) at Namchik Colliery, Arunachal Pradesh

Madhav Kumar

Project 5.6: Palynological investigation of Miocene sediments of Mizoram and Tripura

A rich and diversified palynofloral assemblage has been recorded from the Bhuban Formation exposed along Unakoti road, Kailashahar district, Tripura. The palynofloral assemblages from the section are assigned an early Miocene in age, based on marker species, such as *Spinizonocolpites echinatus*, *Striatriletes susannae*, *Pteridacidites tripuraensis*, *Osmundacidites wellmanii*, *Acanthotricolpites brevicolpus*, *Retitrescolpites typicus*, *Hibisceapollenites robustispinosus*, *Malvacearumpollis* sp., *Trisyncolpites ramanujamii*, *Chenopodipollis* sp., *Piceapollenites excellensus*, *Abiespollenites cognatus*, *Pinuspollenites crestus*, *Operculodinium centrocarpum*, *Cleistosphaeridium diversispinosum*, *Spiniferites mirabilis*, *Oligosphaeridium complex*, *Densoisporites velatus*, *Callialasporites* sp., *Cannanoropollis trilobatus*, *Cuneatisporites rarus*, etc.

The sediments were deposited in a marginally marine environment under terrestrial influence, as indicated by the presence of very rare dinocysts and significant amount of cuticular material. The presence of *Spinizonocolpites* suggests a shoreline inhabited by mangroves. The occurrence of pollen mangrove taxa which belongs to a coastal marsh vegetational community supports the presence of tidal swamps near the area of deposition. The diversity of angiosperm palynoflora, which forms the bulk of assemblage is thought to indicate a dense low land vegetation cover. The taxonomic diversity of palynofloral associations indicates that the deposition of Miocene sediments took place in high energy, brackish water and reducing conditions.

B.D. Mandaokar

Project 5.7: Palynological investigations of the Disang Group its palaeofloristic trends, palaeoecological and palaeogeographical interpretations

Completed palynological study of Disang Group exposed on Silchar-Jatinga Road, North Cachar Hills district, Assam. The lithology mostly consists of shales with sandstone/siltstone. Shale samples yielded good palynological assemblage dominated by pteridophytes, particularly those belonging to families Cyatheaceae, Polypodiaceae, Parkeriaceae, Schizaeaceae, Matanoniaceae, and Osmundaceae. Significant palynotaxa of the assemblage are—*Cyathidites australis*, *C. minor*, *Dictyophyllidites dulcis*, *Todisporites major*, *T. minor*, *Gleicheniidites senonicus*, *Laevigatosporites chatterjii*, *L. levis*, *L. tertiarus*, *Intrapunctisporis intrapunctis*, *Lygodiumsporites lakiensis*, *Hammenisporis susannae*, *H. paucicostatus*, *H. microverrucosus*, *Polypodiisporonites repandus*, *Neocouperipollis achinatus*, *Pellicieripollis langenheimii*, *Margocolporites tsukadae*, *M. kutchensis*, *Lakiapollis ovatus*, *Densiverrupollenites eocenicus*, *Schizaeoisporites phaseolus*, *Triporopollenites vimalii*, *Podocarpidites khasiensis*, *Pinuspollenites crestus*, *Phragmothyrites eocaenica* and *Trichothyrites setiferus*. Besides, reworked Mesozoic palynofossils—*Hamia-pollenites* sp., *Taeniaepollenites* sp. and *Klausipollenites sulcatus* have also been reported. The recorded palynoassemblage points that the area enjoyed moist, warm,

humid, tropical to sub-tropical climate and the sedimentation seems to have taken place in fresh water environment close to the shore. Presence of *Podocarpidites Pinuspollenites* suggests that the topographically elevated areas were not far away from the basin of sedimentation. Taking into account the palynostratigraphical records in the Indian Palaeogene, the present studied sediments are dated as Late Eocene.

Undertook field work to Kohima, Phek and Wokha districts of Nagaland, and collected palynological surface rock samples belonging to Disang Group. From Kohima district samples are collected from Kohima-Dimapur Road (NH 39), Kohima-Chiechema Road, and near Kohima TV station, Jotsoma village. In Phek district, samples are collected near Pfutsero town (about 70 km from Kohima) on NH 150, while in Wokha district samples are collected from Wokha-Mokokchung Road (NH 61). The most noteworthy feature is the Disang-Barail contact, exposed about 18 km from Kohima towards Dimapur, near Zubza village. Here, there is a distinct change in lithology from older to younger sediments. The general lithology of Disang group is alternations of shale (thick) and sandstone (thinly bedded).

G.K. Trivedi

Thrust Area: INTEGRATIVE MICROPALAEONTOLOGY, BIO-PETROLOGY AND ORGANIC FACIES: RELEVANCE TO FOSSIL FUEL CHARACTERIZATION & EXPLORATION (Integrated approach to realizing economic potential in prospective basins)

Marine Micropaleontology Group**Project 6.1: High resolution biostratigraphy, biotic turnover, paleoclimate and relative sea level changes during Late Cretaceous-Early Palaeogene (~80-35 Ma) in South Shillong Plateau, Meghalaya, northeastern India**

Well preserved early Eocene dinoflagellate cyst assemblages are recorded from Damalgiri Plant bed, Garo Hills providing evidence for precise age determination and palaeoenvironment. Documentation and study is in progress. In addition, a manuscript entitled 'Low latitude calcareous nannofossils record across Cretaceous-Tertiary Boundary at Um Sohryngkew, Meghalaya, India' is finalized.

Rahul Garg

Rich and well preserved dinocyst assemblages from upper Maastrichtian-Selandian succession of Khasi Hills

are documented. For refined age control, stratigraphic distribution of significant taxa is calibrated with nannofossil index species ranging from CC25–CC26 zones in Maastrichtian to NP4 zone in upper Danian from the same succession. Integrated microfossil assemblages (calcareous & organic walled phytoplankton) help to define time boundaries. A draft of 'Dinoflagellate cysts from low latitude Maastrichtian-Danian succession at Um Sohryngkew, Meghalaya, northeastern India' is prepared.

Rahul Garg & Vandana Prasad

Following two manuscripts are finalized: 1) New early wetzelielloid dinoflagellate cysts across PETM from Khasi Hills, South Shillong Plateau, northeastern India: evolutionary and palaeoenvironmental significance, and 2) Eocene dinoflagellate cysts from Dilni River section, Garo Hills, Meghalaya, northeastern India.

Rahul Garg, Khowaja Ateequzzaman
(superannuated w.e.f. 31.12.2009) & **Vandana Prasad**

Field excursion to Khasi and Jaintia Hills is undertaken to investigate the entire Cretaceous-Palaeogene succession from bottom Conglomerate to lower part of Kopili Formation exposed at selected sections in Mawsynram, Cherrapunjee and around Lumshnong-Thangskai and adjoining areas. Study of significant sedimentary features for interpretation of depositional environment is carried out. Collection of samples from the Cretaceous outcrops has been done to fill in the gaps while detailed sampling is carried out in early Palaeogene sections.

Rahul Garg, Vandana Prasad & Biswajeet Thakur

Dinocysts and palynofacies studies from early Palaeogene succession (Laitryngew-Latmawksiang sections), Cherrapunji area are carried out to interpret

climatic and relative sea level changes across PETM interval. Excessive humid conditions at the onset of PETM event are interpreted characterized by increase in diversity of terrestrial palynomorphs during post PETM interval. The dinocyst assemblages characteristically show abundance of *Apectodinium* and related forms providing precise age control. A draft manuscript on climate and relative sea level changes as reflected in the palynofloral and palynofacies distribution during PETM event in Meghalaya is prepared.

Study of Kynrem-Mawsmi section, Cherrapunji area (Cretaceous-Palaeocene) shows increase in dinocysts' frequency in the upper Mahadek Formation, dominated by *Areoligera* complex. Palynofacies assemblages reflect varied depositional environments ranging from tidal flat and coastal in the lower part to shallow inner neritic towards upper Mahadek Formation. Grass cuticles with embedded phytoliths are discovered from the earliest part of the Cretaceous succession (? late Campanian-early Maastrichtian) exposed in Um Sohrengkew section. The present find stretches evolution of grasses further back in time than reported earlier by Prasad et al. (2005).

Vandana Prasad & Rahul Garg

Project 6.2: Mesozoic nannofossils from western Indian continental shelves and its palaeobiogeographic significance

The Pariwar Formation overlying fossiliferous Bhadesar and ?underlying datable Abur formations in Rajasthan Basin has been precisely dated for the first time as early to Middle Albian on the basis of presence of well diversified, moderately preserved calcareous nannofossil assemblage of over 50 species belonging to the upper part of *Chiastozygus litterarius* Zone CC7b/*Prediscosphaera columnata* Zone CC8 of Sissingh 1978 corresponding with NC8/9 zones of Roth (1978). Environment of deposition for Pariwar Formation is envisaged as coastal marine. Datable nannofossil taxa include– *Farhania varolii* (Jakubowski, 1986) Varol, 1992; *Prediscosphaera columnata* (Stover, 1966) Perch-Nielsen, 1984; *Tranolithus orionatus* (Reinhardt, 1966a) Reinhardt, 1966b and *Seribiscutum primitivum* (Thierstein, 1974) Filewicz *et al.* in Wise and Wind, 1977. These forms are zonal or subsequent markers in various zonal schemes (Jakubowski, 1987; Mutterlose, 1992; Bown *et al.*, 1998; Jeremiah, 2001). However, Sissingh's and Mutterlose's zonal classifications of mid-latitude have been followed here because of mid latitudinal position of Jaisalmer Basin shown in most palaeogeographical maps.

Cyclagelosphaera margerelii Noël, 1965; *Faviconus multicolumnatus* Bralower, 1989 in Bralower *et al.*, 1989 and *Tubodiscus jurapelagicus* (reworked) (Worsley, 1971) Roth, 1973 are Jurassic reworked forms present in the assemblage.

An episode of warm water influx in the nannofloral assemblage of Albian age sediments of Jaisalmer Basin is indicated by low diversity assemblage containing a few occurrences of *Nannoconus* species both in surface (Pariwar Formation) and subsurface (Tanot Bore well1) samples. This warm water evidence indicates the sensitivity of the system to latitudinal exchange of water masses. *Nannoconus* abundance is restricted to warm surface water of Tethyan realm only. The present finding of co-existence of *Nannoconus* with cold water, high latitudinal representative *Seribiscutum primitivum*, is unique in the world and suggests mixing of Tethyan and Austral realm cold water high latitude nannoflora at a mid latitudinal position of 30° S and possibly the area was transitional between low latitude Tethyan and high latitude ?Austral provinces and it also implies to the limit of their ecological tolerances. Record of *B. constans*, *Z. erectus*

indicates surface water nutrient rich upwelling conditions. A manuscript entitled 'Albian age calcareous nannofossils from Tanot Bore-well, Jaisalmer Basin in Rajasthan area, Western India' is finalized.

Work continued on subsurface Cretaceous age calcareous nannofossils biostratigraphy from Tanot well-1, Jaisalmer Basin, Rajasthan for Ph.D. Light microscopic microphotograph documentation of recorded nannofossil taxa are family-wise arranged in several plates. Taxonomic treatment of various taxa is in progress.

Conducted a field excursion to Kutch (by JR) and samples from Kharol, Nara Shale and Chitrod sandstone members of Washtawa Formation, Patasar shale and Fort sandstone, Adhoi members of Kantkot Formation, and Gamdau Formation of Wagad Island are collected to check the nannofossil productive levels. Samples from Kakindia Bet area of Khadir Island are also collected for recovery of calcareous nannofossils. Representative calcareous mudstone sample of Chari Formation from Jawahar Nagar section from Mainland Kutch are also collected.

Jyotsana Rai & Abha Singh

Project 6.3: Integrated diatom stratigraphy and palynofacies analysis of Tertiary sediments of Andaman-Nicobar Group of Islands: Implication to palaeoclimate and basin evolution

A rich palynofloral assemblage mainly consists of fungal spores and microthyraceous ascostromata, pteridophytic spores, gymnospermous and angiospermous pollen grains has been recovered from the sediments of Port Blair Formation exposed along Andaman Trunk road at Sippighat near Port Blair. Significant taxa of the palynoflora have been compared to those of the extant members of the family's viz., Microthyraceae, Cyatheaceae, Dicksoniaceae, Osmundaceae, Schizeaceae, Parkeriaceae, Polypodiaceae, Malvaceae, Sapotaceae, Podocarpaceae, etc. The distributional pattern of palynofossils in the measured stratigraphic sequence has been analyzed and interpreted throwing light on its dating potential and environment of deposition. The palynoflora has been compared with Late Eocene/ Oligocene assemblages recorded from various sedimentary basins of India and have been assigned an Early Oligocene age for the Port Blair Formation. Recorded palynotaxa indicate the prevalence of a moist, subtropical climate in the studied area.

Morphotaxonomic study of the recovered

palynofossils from west coast section of Neil Island and Metha Nala section of Havelock Island are continued. Quantitative analyses of the recovered palynofossils from both the sections are carried out for palynological zonation and correlation of the sections. Data interpretation of the recorded palynofloral assemblages from West coast section is made. Recorded palynoflora mainly dominated by several species of *Coscinodiscus* and *Thalassiosera* confirms a deep water marine environment for the deposition of sediments during Miocene in the area. Data interpretation of the recovered palynofossils from Radhanagar Beach cliff section of Havelock Island and South Point section of Port Blair is being carried out. Also undertook a field excursion for systematic collection of palynological samples as well as for field observations of Long, Swai Bay, Guitar and Neill formations of Andaman and Car Nicobar Islands. 128 samples from 10 measured stratigraphic sections have been collected. Reconnaissance survey is also carried out at several other localities to find out their lateral extension in regional scale.

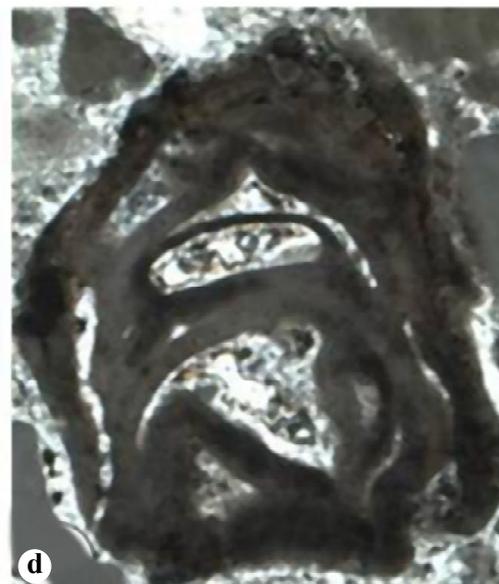
Samir Sarkar

Project 6.4: Taxonomic analysis of calcareous algae from the Cenozoic sediments of Andaman-Nicobar Basin and its implications on palaeogeography, palaeoecology and palaeobathymetry

Taxonomic analyses of coralline red algae in thin sections, photomicrography, description and identification of the taxa from the rock samples of Hut Bay (Little Andaman) belonging to Middle Miocene age have been done. Dominance of non-geniculate coralline algal taxa belonging to subfamily Melobesoideae (Family Hapalidiaceae) in association with other non-geniculate taxa of subfamily Mastophoroideae and Lithophylloid

(Family Corallinaceae) along with species of geniculate coralline alga *Amphiroa* (Family Corallinaceae) is the characteristic feature of this algal assemblage. Interpretation on the palaeoecology based on the algal assemblage has been made.

A field excursion to Andaman and Nicobar Group of Islands has been carried out in South Andaman, Ritchie's Archipelago (of Andaman Group of Islands) and



a. Kakana Cliff Section in Car Nicobar Island (Middle Pliocene), **b.** *Amphiroa* sp. from the studied section. **c.** Hut Bay Limestone Quarry Section in Little Andaman Island (Middle Miocene), **d.** *Phymatolithon* sp. from the studied section.

Car Nicobar Island (Nicobar Group of Islands). During the visit, for the study of calcareous algae, field survey of the outcrop sections has been done and samples have been collected from Chidya Tapu, Ross, Chatham, Corbyn's Cove, Wandoor, Jolly Boy and Madar Par localities of South Andaman and Havelock Island of Ritchie's Archipelago. In the Car Nicobar Island (Nicobar Group of Islands) detailed studies of the outcrop sections at Malacca, Mus, Sawai Bay, Arong and Kakana localities

have been done and rock samples have been collected.

The diversification of the family Sporolithaceae (Corallinales, Rhodophyta): A witness and a survivor to the K-PG Mass Extinction in India have been studied and finalized. Besides, contemporary taxonomic perspectives of fossil coralline red algae have been reviewed and their possible origin *vis-à-vis* evolution has been traced.

A.K. Ghosh

Organic Petrology Group

Project 7.1: Biopetrological investigations on the coals of Wardha-Godavari coalfields in relation to coal bed methane

Carried out petrological study of the entire coal sequence intersected up to the depth of 568 m, from borehole No. MKD-23, Kothagudem area, Godavari Valley Coalfield. The maceral study has revealed that the top, middle and bottom sections of Seam I are characterized by vitrinite rich or vitric type of coal. However, the Queen seam contains mixed type of coal and the King

seam has inertinite rich or fusic type of coal constitution. The coals of this area have attained high volatile bituminous C stage of the rank. The petrological study also suggests that the basin of deposition experienced an alternate oxic and anoxic moor and wet moor with intermittent moderate to high flooding.

O.S. Sarate

Project 7.3: Organic petrological and geochemical characterization of South Indian lignite deposits

Maceral data collected from different mine sections of Neyveli lignites are further processed to show the distinctive behavior of varied macerals of huminite, inertinite and liptinite groups to deduce the facies control in time and space. Two axial diagrams depicting huminite versus inertinite maceral distribution are prepared on mineral matter free basis suggesting the variable oxidative and reductive conditions in the development of Neyveli swamp. Consistently downward increasing tendency in the huminite group of macerals have been noticed in the samples studied representing the deeper part of the basins.

Inertinites represents very less amounts in comparison to the huminites. Liptinites chiefly constitute spores, pollens, cutinite, suberinite, resins, liptodetrinite occupy the intermediate status. However, fluorescence microscopic characteristics show high incidence of its representation in most of the samples studied. The pyrites recorded show framboidal characteristics suggesting the prevalence of reducing condition during the development of these seams in the swamp. However, the disseminated behavior of pyrites has been recorded in the woody part of the samples.

Rakesh Saxena

Project 7.4: Organic matter characterization of lignite-bearing successions of western India

Finalized the petrological data (macerals both under normal and fluorescence modes, and huminite reflectance) of lignites from Khadsaliya mine (Bhavnagar district, Saurashtra), Gujarat. Maceral compositions of these lignites reveal, due to high amount of macerals of huminite group (average 78%), that this deposits have formed from wood dominated forest vegetation in a fast subsiding basin experiencing almost uniform environmental conditions with slight intermittent fluctuations. The rank based on huminite reflectance ($R_{o, mean}$ %) values indicate that the lignites are less mature and have not reached the sub-bituminous stage of coalification as those of the lignites from Panandhro field (Kutch Basin). High pyrite content in the Khadsaliya lignites makes them not much suitable for combustion purpose.

Continued petrological investigation on the lignites from Tadkeshwar mine (Surat district, Cambay Basin) for their maceral compositions and rank. In the studied

lignites, huminite group is represented by almost all the macerals. In general, detrohuminite (attrinite + densinite) is dominant in these lignites followed by structured telohuminite. Semifusinite, fusinite, inertodetrinite and funginite represent the inertinite group, though in low amount. The liptinite group is mainly represented by resinite, sporinite, cutinite, and suberinite. The mineral matters associated with the lignites are mainly represented by argillaceous matter and pyrite. Observations under fluorescence mode show manifold increase in liptinite contents, chiefly constituted by liptodetrinite (detritus) and resinite. The huminite reflectance values suggest that the studied lignites are less mature (of brown coal or lignitic stage). Overall predominance of huminite macerals indicates the existence of woody forest contributing as the source vegetation and reducing conditions of swamp during the formation of lignites, with only minor fluctuations in swamp water/ environmental conditions.

Alpana Singh, B.D. Singh & O.P. Thakur



Studied lignites from Matanomadh mine (Kutch Basin) for their microconstituent's characterization. The study revealed that these Eocene lignites are predominant in huminite macerals (average 69%) followed by liptinite (av. 8%) and inertinite (av. 3%) macerals, along with low to moderately high amount of associated mineral matters (av. 20%). Under fluorescence mode, however these lignites show high frequency of liptinite macerals (av. 33%) formed chiefly by liptodetrinite and resinite. The overall petrographic composition points a lagoonal condition for the formation of Matanomadh lignites. The mean huminite reflectance values (0.28-0.34%) suggest brown coal or lignitic stage/rank for the lignites.

B.D. Singh & Alpana Singh

Visited offices of Directorate of Mining and

Geology (DMG) and Rajasthan State Mines and Minerals Limited (RSMML) in Jaipur and had discussions on the occurrences of lignite deposits and mining activities in Rajasthan Basin. Undertook field work in lignite-bearing areas of the basin and collected lignite and associated sediments (shale/ clay) for organic petrological studies from working mines of Barmer (Giral) and Bikaner (Barsingsar, Gurha) districts. Bore core samples of lignite (MEK-113, east of Kurla block) from Barmer Basin have also been collected through the courtesy of MECL. A few plant fossils (leaf) have been collected from the clay horizon (above the lignite seam) from the Gurha mine. Also surveyed Matasukh and Kasnau lignite mines of Nagaur district, but the collection of lignites could not be possible due to confined aquifer (water logging) problem.

B.D. Singh & O.P. Thakur

Fossil Fuel Exploration Research Group

Project 8.1: Development of Advance Centre of Applied Palynology and Stratigraphy for Fossil Fuel Exploration Research

Project proposal for establishment of the 'National Centre of Applied Palynology and Stratigraphy for Fossil Fuel Exploration' and "Central Core Lab Facility" offering Palynology as a Tool to the Industry in Hydrocarbon Exploration Research has been updated and revised as per OADB guidelines and submitted to Directorate General of Hydrocarbons for consideration.

N.C. Mehrotra & team of Scientists

(engaged in Palynological & Organic Petrological studies)

Processed and studied coal samples received from BRGM, France/ MECL, Nagpur. The samples belong to the Tertiary field in the frame of the MECL-BRGM Project on resource estimation in respect of the Oil Shale deposits

in north-east India. The samples have been analysed as under- maceral contents (both under normal and fluorescence modes), mineral matter association and vitrinite reflectance ($R_{o, mean}$ %). A report containing these data along with photographs is forwarded to both the agencies.

B.D. Singh, Alpana Singh & O.P. Thakur

Prepared a report on palynological analysis, age, sedimentary organic matter characteristics and palaeoenvironment of deposition of Tertiary coal samples provided by BRGM (France) and MECL (Nagpur) under their oil shale project in north-east India.

Madhav Kumar

Thrust Area: MULTI PROXY PARAMETERS FOR QUATERNARY PALAEOCLIMATE RECONSTRUCTIONS, VEGETATION DYNAMICS, RELATIVE SEA LEVEL CHANGES AND ANTHROPOGENIC INFLUENCE (Integrated Approach to Climate Change, Modelling and Sustainable Ecosystems)

Quaternary Palaeoclimate Group

Project 9.1: History of mangrove vegetation in Mahanadi Delta

Chilka Lake (19°28'22" N; 85°05'22" E) along the eastern coast of India in Orissa is one of the largest brackish water bodies in Asia, and is showing alarming environmental degradation. The palynological

investigations of 350 cm deep sediment core (CHI-31) collected from eastern region dated back to 1,575 ± 35 yrs. BP exhibited different dataset of palynomorphs at different levels of sedimentation. The core exhibited the

poor occurrence of peripheral mangroves and has shown the dominance of hinterland and ubiquitous plants, such as members of Rubiaceae, Oleaceae, Malvaceae, Poaceae, Cyperaceae, Chenopodiaceae and *Casuarina*, *Anacardium*, *Holoptelea*, along with fern spores. This dataset provides a clear cut vision of marine regressive phase.

The environmental magnetism studies from two sediment cores (CHI-1 & CHI-51) have been carried out at Mangalore University, Mangalore under the guidance of Dr. R. Shankar. Based on the reflections of various parameters and their parametric ratios, the preliminary investigations of cores have been completed. The investigations of CHI-1 revealed low magnetic susceptibility (Xlf, $8-40 \times 10^{-8} \text{m}^3/\text{kg}$) and SIRM values ($88-360 \times 10^{-5} \text{Am}^2/\text{kg}$) which indicate lower concentration of magnetic minerals. There is not much variation in Xlf from 354-222 cm, which relatively increases to two folds between 222-152 cm. Thereafter the susceptibility decreases gradually up to 81cm and peaks at 42 cm and reduces towards the core top. All the concentration dependent magnetic parameters (Xlf, Xfd, Xarm, SIRM and HIRM) show similar trend throughout the core. The

magnetic property of sediments between 145-222 cm suggests period of humid conditions and high rainfall. The S-Ratio greater than 0.85 is indicative of higher proportion of magnetically soft minerals; it is supported by IRM acquisition curves. Whereas, in CHI-51 core, the samples at depth of 530-278 cm are weaker; may correspond to relatively arid condition, thereafter higher rainfall causing relatively strong pedogenesis resulted in increasing Xlf values up to 208 cm. Gradual decrease in the parameter is observed from the depth to 89 cm; samples from 89-34cm having Xlf in the same range as the bottom most part of the core, suggestive of similar arid conditions with subsequent rise thereafter. There are similar trends of concentration, grain size as well as mineralogical magnetic parameters in both the cores. Though there is a minor fluctuations corresponding to variation in rainfall and temperature with a major notable peaks. The climatic scenario pertaining to the lake environment would be better understood on comparing with other proxy records and make our data set stronger for an overall scenario of monsoonal fluctuations during the Holocene.

Asha Khandelwal (superannuated w.e.f. 31.08.2009) &
Shilpa Singh

Project 9.2: Evolution of Mangroves and Coastal Vegetation; Its implications in Palaeoclimate and sea-level studies during Quaternary

Palynological and geochemical studies of 3 sediment cores (each 4-5 m deep) retrieved from Visakhapatnam coastal area (Andhra Pradesh) have been completed. The radiocarbon age of the sediment at the base is ~10-11 kyrs BP. Three phases are categorised on the basis of palynological study, which is supported by sedimentology and geochemical status of the sediment. Phase-1 (between ~11 and 6 kyrs BP) is characterised by high percentage of pollen taxa that belong to wet evergreen and moist deciduous rainforest. These constitute pollen grains of *Cullenia*, *Eugenia*, *Shorea*, *Hopea*, *Diospyros*, *Anogeissus*, *Bombax*, *Buchanania*, *Madhuca*, *Melia*, *Garuga*, etc. Later between ~5 and 3 kyrs BP, a drastic decline in pollen assemblage is observed; showing signatures of low percentage of dry deciduous forest community. Dominance of *Boswellia*, *Dalbergia*, *Lannea*, *Mitragyna*, *Schleichera*, *Butea*, *Casearia* and *Lagerstroemia* are recorded. However,

the last Phase-3 shows rare occurrence of arboreal pollen (tree pollen) except exotic pollen of *Acacia*, *Casuarina*, and *Eucalyptus*. Low percentage of herbaceous pollen taxa dominated by ubiquitous pollen like Poaceae, Cyperaceae, Chenopodiaceae and Amaranthaceae type of pollen could be recorded. Dominance of algal matter in the sediment is recorded in this phase.

The qualitative and quantitative vegetation reconstructed through palynology shows vegetational change from wet evergreen moist deciduous lowland forest community to dry deciduous forest during Holocene. Results indicate a shift in climatic conditions from warm and humid to dry and arid conditions since middle Holocene. Rapid decline in pollen assemblage during Late Holocene suggest further deterioration in climatic conditions, which was enhanced by extensive anthropogenic activity in the coastal areas.

Anjum Farooqui

Project 9.3: Multi-proxy palaeoclimatic studies in coastal and marine sediments of western Indian region

Investigations of dinoflagellate cysts and palynofacies assemblages from the upper 1 m profile of the GC-1 core (Karawar Coast) revealed significant variation in their vertical distribution pattern reflecting salinity fluctuations due to precipitation related freshwater terrestrial runoff. AMS dated selected levels are awaited for further interpretations. Additionally, 52 surface sediment samples off Karawar coast from eastern Arabian Sea are processed for palynofacies investigations. Preliminary data shows significant variations in dominance of peridinioids dinocysts in shallower shelf region while gonyaulacoids, mainly *Spiniferites* group, dominate in slope and deeper transects.

Vandana Prasad, Rahul Garg & Biswajeet Thakur

Primary productivity and runoff related changes during NE and SW monsoon periods are studied, using biotic proxies (diatoms, palynofacies) in the Alleppey mud banks, Kerala. A comparative account of fresh water and marine water diatom population and distribution pattern of terrestrial and marine organic matter (palynofacies) have been documented at different isobaths (5, 6, 7, 8, 9, 9.75 & 11 mts) in surface sediment samples. Low diversity in diatom population during both the monsoonal peaks is noted. However, organic matter distribution based

on palynofacies shows differential distribution pattern during SW and NE monsoons. Statistical method (ANOVA) was performed on diatoms and palynofacies counts. The study provides a significant result in the palynofacies behavior pattern that further reaffirms that high precipitation induced runoff during SW monsoon is the governing factor in the formation of mudbanks in this region. A manuscript entitled 'Primary productivity and organic matter distribution study during SW and NE monsoon: A case study from Alleppey mudbanks, Kerala' is prepared.

The phytoplankton study from 17 stations of the Vembanad Lake from the surface water is under progress. The phyto-plankton study of the region shows the dominance of centric diatoms with the abundance of low salinity tolerant diatoms, viz. *Cyclotella*, *Actinocyclus ingens*, *Thalassiosira*, etc. The SK-237 sediment samples along the Ponnani coast from the depth transect of 25 m to 2150 m for diatoms have also been carried out. This region of the Arabian Sea is dominated by marine centric diatoms and a few diversified fresh water diatoms are found to occur along the coastal realm of Ponnani upto a depth of 102 m. The study is under progress.

Biswajeet Thakur, Vandana Prasad & Rahul Garg

Project 9.4: Studies on Quaternary vegetation and climate change in southwestern Madhya Pradesh, based on pollen proxy evidence

Pollen rain study of 17 surface samples consisting, 6 each from sal forest at Kiktiha, Shahdol district (Madhya Pradesh) and teak forest at Shahganj, Sehore district and 5 from mixed forest at Sapana, Betul district (Madhya Pradesh) has revealed that *Shorea robusta* (sal) and *Tectona grandis* (teak) are recovered with average 1.5% pollen each only, despite being enormous pollen producers. The under-representation of both the taxa could be attributed to their poor preservation in the sediments. The consistent presence of *Madhuca indica* and Sapotaceae denotes their frequent occurrence around the study sites coupled with good preservation of their pollen. However, *Terminalia*, *Lagerstromia*, *Emblia officinalis*, *Syzygium*, *Sterculia*, etc. are retrieved sporadically owing to their low pollen productivity as they exhibit entomogamy. Among the non-arborescences the high frequencies of grasses followed by sedges, Tubuliflorae, Chenopodiaceae, etc. correspond with their presence in the ground flora.

Completed pollen analytical investigation of 1.25 m deep sediment core from Kachia-Jhora, Sehore district, depicting the presence of mixed tropical deciduous forest constituted of *Madhuca indica*, *Lagerstroemia*, *Adina cordifolia*, *Acacia*, *Symplocos*, *Terminalia*, *Syzygium*, etc. since last 1300 years. The vegetation composition suggests that a warm and humid climate prevailed in the region, which is also confirmed by the encounter of moisture-loving epiphyte-*Loranthus* and epiphyllous fungi-Microthyriaceae in good numbers. The retrieval of culture taxa, such as *Artemisia*, Chenopodiaceae, Caryophyllaceae, Brassicaceae, etc. infers the anthropogenic activities in the region. Partly pollen analysed 1.5 m deep sediment profile from Ghatwala Nala (Sehore district). The pollen assemblage has shown the presence of open vegetation encompassing mainly grasses, sedges, Asteraceae and Chenopodiaceae/Amaranthaceae with scattered trees viz., *Acacia*, *Madhuca indica*, *Terminalia*, *Holoptelea*, *Bombax ceiba*, etc. in the region. The analysis of rest of the samples is in progress.

Pollen analytical investigation of 2 m deep sediment core from Sapna Lake, Betul district (Madhya Pradesh) has demonstrated that the area had *Acacia* dominated forest under a warm and less-humid climate during the early phase of sediment accumulation. *Madhuca indica*, Sapotaceae and *Sterculia* were close associates of these forests. Later on, *Acacia* forest was succeeded by mixed deciduous forest with *Madhuca indica* and Sapotaceae as major constituents. This change in the floristic pattern is suggestive for the onset of a warm and humid climate in the region. Radiocarbon dates are awaited for the chronological demarcation of vegetation shifts and climate change in the region. The investigation of 4 spider webs from Khedla (Betul district) has portrayed an enormous quantities of pollen of which *Mentha*, *Madhuca indica*,

Holoptelea, *Lannea coromandelica*, *Aegle marmelos*, *Schleichera*, etc. are the principal ingredients. The pollen composition of spider webs exhibits a close coherence with the local vegetation.

Melittopalynological study of 2 honey samples (P-1 & 2) from Pokharni, Harda district has brought out huge quantities of pollen grains. The predominance of pollen of *Brassica campestris* and *Alternanthera cf. sessilis* in P-1 & P-2 with the frequencies of 68.8% and 63.17% respectively depicts that these plant taxa were the major sources of nectar and hence the honeys are of monofloral nature. The honey production occurred from the late winter to early spring since the main forage plants attain peak flowering during this period.

M.S. Chauhan & Md. Firoze Quamar

Project 9.5: Studies on Quaternary vegetation and Climate from Himalaya

Palaeontological analysis of sedimentary profiles from temperate zone of Kumaun Himalaya has revealed the knowledge of floral as well as faunal macro-remains. The former have shown a large number (>100) of Holocene Legume fruits, hitherto not reported from Himalaya. These are small in size, showing two seeds each and possess specific distribution. The age of investigated sediments ranges since Early Holocene, but fruits in question are obtained from Late Holocene only. In the beginning, their frequency was low but soon after became considerably high. Their presence, specific distribution and onwards increase indicate that the area enjoyed considerable anthropogenic activities during this tenure. The faunal-remains have shown Molluscan shells which are also qualitatively poor, but quantitatively rich and have shown specific distribution. Documented a paper

elaborating Holocene Molluscs and their climate response. In the beginning of sequence (Early Holocene-Middle Holocene) area had no Molluscs but near onset of Late Holocene plenty of animals of a form, i.e. Planispiral Gastropods came into existence; indicating change in climate to suitable humid conditions. Subsequently, two other forms, i.e. Conispiral Gastropods and Bivalves also appeared; reflecting further amelioration of climatic conditions. Thereafter, the latter developed forms disappeared, but earlier one continued indicating repetition of earlier conditions at the region. The appearance and specific distribution of Molluscs indicate that area enjoyed fluctuating humid condition during Late Holocene. Since Molluscs feed plant material and hence support presence of sufficient vegetation at the region during Late Holocene.

Asha Gupta

Project 9.6 Proxy climatic signals from lacustrine lake sediments of Upper Assam Basin and adjoining foot-hill forests of Arunachal Pradesh (Subansiri District) during Holocene: A comparative palaeoecological assessment

Pollen spectra from 15 surface samples collected from Hapoli-Ziro Valley, Arunachal Pradesh reveals the predominance of Combretaceae, Arecaceae, *Symplocos*, *Quercus*, *Grewia*, *Schima*, *Dalbergia* and fern allies like *Lycopodium*, *Pteris*, *Cheilanthes*, *Osmunda*, *Drynaria*, *Gleichenia*, *Polypodium*, etc. Whereas, conifers are largely comprised of *Pinus*, *Podocarpus*, *Abies*, *Picea* and *Tsuga*. The presence of *Nymphoides*, *Myriophyllum* and *Typha* in the sediment indicates existence of water body since long. However, the preliminary study predicts high rate of precipitation during deposition.

Palynoassemblage from one sedimentary profile (2.20 m deep) from Hapoli-Ziro valley predicts the existence of moist tropical forest under relatively cool and humid to warm and humid climate in recent past. The occurrence of Cerealia palynomorph along with *Rumex* and *Xanthium* in high value may attribute intensive anthropogenic impact causing deterioration of nearby forest and expanding valley area.

Twenty-five modern moss and subsurface soil samples have been analyzed to assess pollen/vegetation relationship from Namchik reserve forest under Tinsukia

district, Assam belongs to Naga-Patkai range in which characteristic vegetation ranges from mixed deciduous to semi-evergreen type. The study has reflected predominance of nonarboreals over arboreals, signifying the existence of a low elevation open land forest. A good correlation between plant cover and pollen assemblage has been experienced in the scenario. Palynoassemblage from one 6 m core (NP-04) from Namchik reserve forest

predicts the existence of tropical mixed deciduous to semi-evergreen forest in recent past. Evidence of degraded pollen and spores along with high frequency of fungal elements indicate biological degradation in sediment. Radiometric dates and detail palynostratigraphical results are awaited.

S.K. Bera & S.K. Basumatary

Dendrochronology Group

Project 10.1: Development of long-term high resolution proxy climate record from the Himalayan region

Completed crossdating of 120 Himalayan pencil juniper samples collected from Lahaul, Himachal Pradesh. The ring-widths of dated samples are measured and processed to prepare the ring width chronology. The ring-width measurements are processed following methods to retain low frequency variations in the mean chronology. The chronology extending back to AD 1400 showed strong negative relationship with temperature and direct relationship with monthly precipitation during the growing season. The chronology needs to be supplemented further

with more site chronologies in order to develop strong calibration models for climate reconstruction.

The Himalayan cedar samples collected from different sites in Lahaul are also processed for crossdating. Thirty core samples of this species have been crossdated, the age of the oldest sample extends back to AD 1500. The ring-width measurements of dated samples are being done for further analyses.

R.R. Yadav

Project 10.2: Analysis of climatic changes based on multi-proxy data during Holocene from Peninsular and Himalayan regions

Finalized paper 'Spatio-temporal variation of alpine vegetation vis-à-vis climate during Holocene in the Himalaya' (jointly with P.S. Ranhotra). The paper deals with the palynological analysis from subsurface sediments from tree line of the Himalaya to understand the past spatio-temporal variation of alpine vegetation in relation to climate change. This paper describes, in the northwest Himalayan region, climate was warm-moist during major part of the Holocene with short phases of interruption of cooler and drier phases around 8.3-7.3 ka BP, 6- ~3 ka BP and 850 yrs BP. In contrary, data from the northeast

Himalaya is available only for Late Holocene. It reveals warm and moist climate around 1,800 yrs BP, similar to conditions prevailing at present. Subsequently, further amelioration of climate has been recorded around 1,100 yrs BP (~AD 985) that corresponds to medieval warm period. Around 550 yrs BP (~AD 1400), a trend towards cooler and comparatively less moist climate might be the impact of Little Ice Age. This is followed by an amelioration of climate comparable to present day climatic condition.

Amalava Bhattacharyya & S.K. Shah

Palaeoethnobotany Group

Project 11.1: Palaeoethnobotany: Ancient man, plants and environment in northern and north-western India

Anatomical investigation of wood charcoal samples are carried out from Chalcolithic site Naimisharyan / Neemsar, District Sitapur (Uttar Pradesh), an ancient site known for its dense forest and religious significance. Blocks are prepared of the wood charcoal pieces by double embedding method in wax and celloidin fixing solutions. Sections are cut in three planes, viz. TS, TLS

and RLS with the help of sliding microtome and their permanent mounted slides are prepared. With the help of anatomical details of the wood charcoals, they have been identified as belonging to the timbers of *Acacia* sp., *Aegle marmelos*, *Azadirachta indica*, *Dendrocalamus strictus*, *Ficus religiosa*, *Holoptelea* sp., *Mangifera indica*, *Syzygium* sp., *Tectona grandis*, etc. The studies

are in progress with aim to reconstruct the regional forest wealth, ecological conditions and exploitation by the ancient settlers during Sunga-Kushana period, around 2500-2000 years ago. A manuscript entitled 'Palaeoethnobotanical finds from ancient Naimisharanya, District Sitapur; U.P. during Kushana Period (100-300 A.D.)' is finalized. Additionally, collected samples of botanical remains from archaeological site Ghorakatora, District Nalanda (Bihar) during excavation conducted by ASI (Bihar).

To study the plant economy of the ancient settlers at Ahichchhatra, 14 km north of Aonla, a tehsil headquarter in District Bareilly (Uttar Pradesh), the collection of carbonized botanical remains is carried out (jointly with A.K. Pokharia) from PGW, NBPW, Kushana and Mauryan levels. The site lies between the Ramganga and Ghagan Rivers. The work began and continued in parallel with the excavations undertaken by ASI, Agra Circle. The botanical remains are retrieved by water floatation technique from two trenches, viz. Bx78x28 (Qdt. 3 & 4) and Bx50x75 (Qdt.3). Floatation allowed recovery of all size classes of botanical material preserved in the sediment, making qualitative and quantitative analyses possible. Recovery of plant remains, such as charred seeds and fruits have been found mixed with little charcoal pieces, have resulted in the material evidence to reconstruct the model of agriculture and ecological surroundings of the ancient settlement.

The samples comprised of rich organic content of small sized wood charcoal pieces along with, carbonized seed and fruit remains of field crops belonging mainly to cereals, legumes/pulses of west Asian origins, viz. Barley, Bread-wheat, Field-pea, Grass pea, and Lentil, along with indigenous Rice, Green gram, Black gram, Pigeon pea?, Italian millet, etc. and a number of weeds associated with winter and summer season crops as well as wild taxa, viz. Goose grass, Blue stem grass, Blue or meadow grass, *Carex* sp., *Fimbristylis* sedge, Flat sedge, *Panicum* sp., White Goose foot/Bathua, Hurhur, Jujube, Job's tear, Barnyard/sawan, Pimpernel/Jonkh-mari, Tick clover, *Panicum* grass, and Spikerush sedge of palaeo-ethnobotanical significance. Ahichchhatra strategically in

the upper reaches of Middle Ganga Valley, epitomizes the cultural flourish typical of the Ganga Valley. The site has a great potential for palaeo-ethnobotanical investigations which would be helpful in understanding the human plant relationship during Chalcolithic and Early historic times. The samples investigated have proved productive, revealing advanced agricultural practices in this region of Ganga plains in ancient times.

Chanchala Srivastava

Further studies are continued on samples of carbonised remains from Neolithic Hetapatti, Allahabad, (Uttar Pradesh). Assemblage of cereals (*Oryza sativa*, *Hordeum vulgare*, *Triticum aestivum*); pulses (*Vigna radiata*, *Macrotyloma uniflorum*, *Lathyrus sativus*, *Pisum arvense*); oilseeds (*Linum usitatissimum*, *Sesamum indicum*) and fibre-crop (*Gossypium arboreum/herbaceum*) have been encountered during investigation. Remains of weeds and other wild taxa such as *Oryza* cf. *rufipogon*, *Setaria* sp., *Trianthema triquetra*, *Polygonum* sp., *Vicia sativa*, *Rumex dentatus*, *Cyperus* sp., *Chenopodium album*, *Echinochloa* sp., *Ziziphus nummularia* and *Cannabis sativa* are also encountered as an admixture reflecting the ecological condition and ground vegetation near the ancient settlement.

Also studied carbonized samples from a Harappan site at Kanmer, Kutch district (Gujarat). The datasets produced till date from Kanmer surmise that the sign of substantial change or diversification in crop has in fact, witnessed from the Mature phase, which shows a mixed cropping system of winter crops and summer crops. Late Harappan represents a continuation of Mature Harappan, featuring a year-round occupation. However, the evidence of winter oriented cultivation in Late phase is not as good as in Early and Mature occupational phases. Dominance of millets and rice, which are significant as summer, monsoon-watered, cereals in contrast to the winter crops during Late phase gives an impression that these are result of the Harappan agriculture practices in which the control and management of water for irrigation might have been the important factors in the Rann of Kutch.

A.K. Pokharia

Project 11.2: Studies on phytodiversity and ethnobotany of Bilaspur in Chhattisgarh State and Anuppur in Madhya Pradesh State

Collected 208 plant specimens from Amarkantak and identified about 32 plant species belonging to 20 genera and 8 families. Conducted ethnobotanical survey in various tribal areas and documented information about various

uses of plant, such as food, fibre, medicine, fuel, etc. collected from Panika tribe residing in different localities of Amarkantak.

D.C. Saini

Isotope and Geochemistry Group

Project 12.1: Tectonoclimatic signatures in Ladakh and Lahul sectors of Tethyan Himalaya during Quaternary period: A multi-proxy approach using mineral magnetic, geochemical and geochronological parameters

An attempt has been made using the geomorphometric approach to access the Spiti River Basin for neotectonic instability and landscape evaluation. During the Quaternary time ubiquitous mass movements and catastrophic land sliding transported the material from steep slopes to valley bottoms, responsible for forming lakes, while the outburst floods redistributed sediment down valley along with affecting life and property downstream. The morphometric approach has helped in understanding tectonic and climatic perturbation and our observations point towards a tectonically active region with enormous piles of loose, unconsolidated sediment cover which could be disastrous during the slight shift in the climatic and tectonic forces operating in this region.

An integrated approach of magnetic mineralogy and magnetic fabric analyses has been used to study the Khalsar paleolake deposit along the Karakoram Fault Zone (KFZ) in Trans-Himalaya to correlate its fabric with local and regional deformation events. The magnetic anisotropy indicates presence of tectonic fabric and E-W trending vertical to sub-vertical foliation in the entire section with magnetite being the primary remanence carrier in these sediments. The study emphasizes on the application of AMS which could provide vital information regarding the fabric of lake sediments especially in the absence of visible strain/tectonic markers.

Grain size, geochemical (major and trace elements including rare earth elements) and mineralogical data (bulk and clay mineral) have been generated on a variety of surface and subsurface samples from the Indus and the Shyok-Nubra rivers. Sand dune and the Quaternary deposits of these valleys are also analyzed for similar

parameters. Water samples of these rivers are analyzed for REE distribution. It is interesting to note that silicate weathering is prominent in the Indus River Basin while a mix of both silicate and carbonate is observed in the Shyok-Nubra Valley. The REE patterns of the river water is almost identical to the suspended load, however, the abundance is much lower. Similar study has also been carried out on samples collected from the Spiti Valley and interestingly in the upper reaches of the Spiti river, the sediment characteristics is largely controlled by the nallah/first-second order streams, while in middle to lower reaches the sediment character shows significant contribution of the Parachu river sediment.

Room temperature hysteresis loops are measured on 20-25 mg samples from Ladakh palaeolakes with a maximum field of 500 mT, using a Princeton measurements alternating gradient force magnetometer (noise level 10-6 Am² kg⁻¹ for a 20 mg sample). High temperature runs of susceptibility are conducted with an Agico KLY 2 Kappabridge in combination with a CS-2 heating unit. The samples were heated up to 700°C and then cooled to room temperature. These measurements are conducted in Tuebingen University Germany (by BP). In addition, undertook a field excursion to Ladakh (NW Himalaya) for collection of palaeobotanical and Quaternary samples (glacio-fluvial-lacustrine sediments, present lake sediments, aeolian sediment,s etc.) for understanding the palaeoclimatic, tectonic and earth surface processes during late Pleistocene and Holocene time. The upper reaches of the Indus river is mapped for Quaternary sediments and would be clubbed with other data for its meaningful interpretation.

Anupam Sharma & Binita Phartiyal

Project 12.2: Developing and combining physical, geophysical and geochemical methods to make a comparative study of Late Quaternary climate recorded in lake sediments/deposits from Himalayan regions

Thirteen samples collected from lake-shores in Uttarkashi have been processed. The Seven of these yielded sufficient carbon. For Nachiketa lake, 3 samples from 10 to 70 cms depth yielded dates from modern to 670 yrs BP. The dates for 4 samples (from 15-165 cms depth) from Maradunga lake range from modern to 3500 yrs BC in orderly fashion. The Maradunga samples show a lower value (about 5) for C/N ratio in compared to Nachiketa (11-15) indicating comparatively higher domination of aquatic plants. During the year, testing for

a new Ultra Low Background Liquid Scintillation Counter (Quantulus 1220) has been completed and the counter is now in regular use. A variety of samples including charcoal, sediment and wood, numbering 159, are processed for Institute's research and under consultancy, out of which 156 are dated. The calibration for C-14 dates is being carried out as per available latest softwares extending the calibration to about 50,000 yrs BP.

C.M. Nautiyal

Thrust Area: POLAR AND MAJOR PLANETARY EVENTS (Polar research and record of events such as Tsunamis, Earthquakes and Volcanism)

Arctic-Antarctic Research Cell

Project 13.1: Quaternary climatic history of Schirmacher and Larsemann Oasis (East Antarctica), Ny Alesund Area (Svalbard, Norway) and surrounding ocean: A multi-proxy approach based on polar lake sediments

A comprehensive study on 14 lichen samples (6 crustose & 8 foliose) from Schirmacher Oasis and surrounding nunataks, East Antarctica reflect occurrence of palynodebris including local cryptogams, exotic angiosperms and conifers indicating long distance thermophilic pollen dispersal over Antarctica in regular basis. The palynological study on LBM section collected during XXVI Expedition also predicts the occurrence of pollen grains including grass (Poaceae), Caryophyllaceae, Tiliaceae, *Ulmus* and *Pinus* in very low value. Desmids acritarchs along with scattered diatom frustules viz., *Nitzschia*, *Fragilaria*, *Navicula*, *Gomphonema*, *Achnanthes*, *Pinnularia* and *Surirela* from the soil profile suggest poor preservation status under shallow water condition during recent past in Schirmacher Oasis. A paper on the aspect has been finalized.

S.K. Bera, Binita Phartiyal & Anupam Sharma

Studied two sedimentary sections (PDL & SWDL) for mineral magnetic parameters (Susceptibility, ARM & IRMs) from Schirmacher Oasis, which showing good climatic variations (magnetozones). A paper entitled 'Glacial lakes and geomorphological evolution of Schirmacher Oasis, East Antarctica during late Quaternary' is finalized.

Binita Phartiyal, Anupam Sharma & S.K. Bera

Room temperature hysteresis loops are measured on 20–25 mg samples from Schirmacher Oasis with a maximum field of 500 mT, using a Princeton Measurements alternating gradient force magnetometer (noise level 10-6Am² kg⁻¹ for a 20mg sample). High temperature runs of susceptibility are conducted with an Agico KLY 2 Kappabridge in combination with a CS-2 heating unit. The samples were heated up to 700°C and then cooled to room temperature. These measurements are conducted in Tuebingen University, Germany. A research paper on the aspect is under preparation. In addition, geochemical and mineralogical data are partly generated for few sediment cores, a pit and an exposed section. The clay separation process is underway and the slides will be prepared soon and subsequently would be run for X-ray diffraction at some national laboratory.

Few AMS dates have already been obtained and few more are expected shortly. All information will be clubbed for their meaning interpretation.

Binita Phartiyal & Anupam Sharma

High resolution mineral magnetic data has been generated at Palaeomagnetic Laboratory of WIHG, Dehradun, on the Quaternary core raised in the Kolhamna Lagoon, Ny Alesund. Samples have been sent for AMS dating.

Binita Phartiyal

A field trip to Arctic (Ny-Alesund, Svalbard, Norway) has been conducted under 3rd Indian Expedition for the collection of Quaternary and pre-Quaternary sediment samples. Extensive traverses have been taken in order to have the field observations for the identification of potential sampling sites. Quaternary depositional sites are selected at some altitudinal difference, and for palynology and other multi-proxy based palaeoclimatic studies, subsurface sediments are sampled at 5cm intervals by digging trial trenches at 4 locations. To develop the chronology of the profiles, samples are also collected separately from various depths for radiocarbon (C¹⁴ & AMS) and OSL dating. Pit No. 1 (180 cm deep) was dug till the permafrost layer within the moraines along Zeppelin Station road, Pit No. 2 (160 cm) was dug around 2 km south of Ny-Alesund, Pit No. 3 (100 cm) was dug near the Kolhamna Lagoon around 3 km west of Ny-Alesund, and Pit No. 4 (150 cm deep), was dug near the London House within Ny-Alesund.

For the interpretation of past climatic changes in the region, there is a need to develop the modern palynological analogues. For this purpose, 72 surface samples (sediments and moss cushions) have been collected from various locations of the Ny-Alesund region. Moreover, to have an understanding of the dispersal and transportation of local and extra-local spores/pollen within the area during the present time, aeropalynology is done by exposing 8 slides (smear with stained glycerine jelly) per day, in the open, for 24 hours for the duration of the expedition. In continuation to this, around 20 water

samples (sea water from the coast and fresh water from glacial lakes and runoffs) are also collected. Collection of sea floor sediments by grab method is also done from 12 different locations within the Kongsfjorden. Besides the collection of Quaternary sediments, rock samples of Pre-Quaternary formations are collected from the exposed section near Marine Laboratory. The samples (received in February, 2010) are being processed for palynological analysis. The slides that were exposed for aeropalynology are studied and have been found to yield pollen of Oleaceae, Polygonaceae, Chenopodiaceae, Asteraceae,

Saxifragaceae, Ranunculaceae, Caryophyllaceae, Poaceae, Cyperaceae, *Eugenia*, *Pinus* along with fungal and algal bodies.

A collaborative program has been worked out with the Indian Institute of Geomagnetism, Allahabad, to carry out environmental magnetic (EM) studies (one of the palaeoclimatic proxies) on the Arctic samples. The samples have been processed for the same. Finalized three manuscripts related to Quaternary palaeoclimate and glaciology.

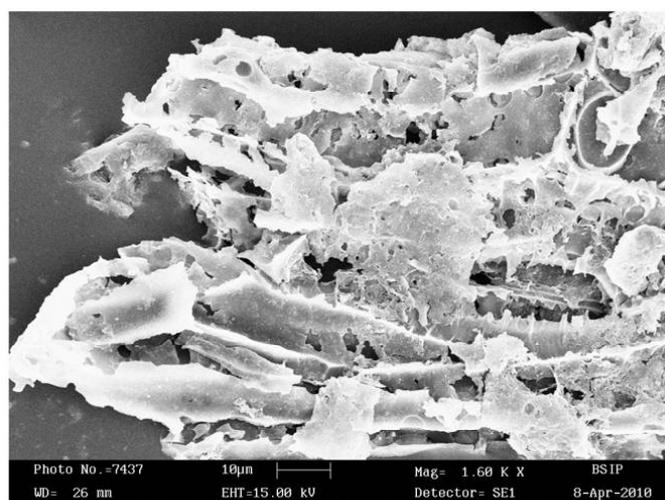
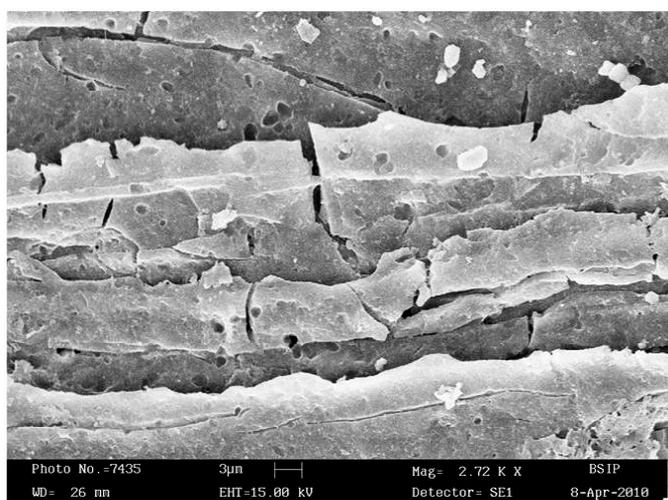
Ratan Kar & P.S. Ranhotra

Project 13.2: Gondwana floristics of Wardha-Godavari Basin, India and Trans- Antarctic Mountain, Antarctica: Evolution, biostratigraphy, palaeoecological signatures and palaeophytogeographical implications

Examined, identified (to some extent) and photographed about 400 specimens from Weller (Permian) and Lashly (Triassic) formations of Allan hills, Transantarctic Mountains, South Victoria Land, Antarctica. The flora is well preserved, rich and diversified. The *Glossopteris* floral assemblage from Weller Formation includes the genera *Glossopteris*, *Gangamopteris*, *Noeggerathiopsis*, *Euryphyllum*, *Ginkgo*, scale leaves and equisetalean axes. Except *Glossopteris*, rest of the genera is represented by one species each. *Glossopteris* are represented by *Glossopteris browniana*, *G. communis*, *G. conspicua*, *G. damudica*, *G. rhabdotaenioides*, *G. angustifolia*, *G. pandurata*, *G. occidentalis*, *G. tenuifolia*, *G. stenoneura*, *G. indica*, *G. major*, *G. retusa*, *G.*

feistmantelii, *G. raniganjensis*, *G. cordaites* and *Glossopteris* sp. The *Dicroidium* floral assemblage from Lashly Formation represents various groups of plants e.g., corystospermales, coniferales, equisetales, calamitales and lycopsids. The flora is dominated by *Dicroidium odontopteroides*, followed by *D. dutoitii* and *D. fremouvensis*. Other taxa include *Umkomasia macleani* and *Pteruchus* sp. - the female and the male fructifications, respectively, of the genus *Dicroidium*. Other taxa are *Heidiphyllum elongatum*, *Phyllothea griesbachii*, *Cyclomeiia capillamentum*, lycosid cone and calamitalean axes.

Finalized the description of megafossils from Lower Barakar Formation of Makardhokra Open Cast Project



SEM photographs showing ruptured bordered pits and vessels from Lashly Formation (Middle-Late Triassic), Allan Hills, Antarctica

and Umrer Open Cast Project, Umrer Coalfield, Nagpur District, Wardha Basin. The assemblage consists of *Gangamopteris clarkeana*, 18 species of the genus *Glossopteris* viz., *G. arberi*, *G. browniana*, *G. communis*, *G. conspicua*, *G. damudica*, *G. feistmantelii*, *G. indica*, *G. intermedia*, *G. longicaulis*, *G. rhabdotaenioides*, *G. recurva*, *G. searsolensis*, *G. spathulata*, *G. stenoneura*, *G. subtilis*, *G. syaldiensis*, *G. tenuifolia*, *Glossopteris* sp., *Scutum leslium*, *Noeggerathipsis hislopii* and equisetalean axes. In addition, finalized a manuscript on dispersed gymnospermous seeds from the Early Permian of Makardhokra Open Cast Project. Systematically analysed the seed taxa, viz. *Samaropsis feistmantelli*, *Palaeocarpus birsinghpurensis*, *Palaeocarpus* sp., *Otofeistia* sp., *Rotundocarpus ovatus* and a new species of *Rotundocarpus*.

Work on floral and sedimentary organic matter characterization from Triassic of Allan Hills, Transantarctic Mountains has been carried out (jointly with Sankar Chatterjee, Madhav Kumar and Ratan Kar). The floral assemblage indicates fluvial and non-marine lacustrine conditions. Quantitative analysis of sedimentary organic matter exhibits dominance of biodegraded terrestrial remains followed by charcoaled plant fragments, black debris, structured terrestrial and rare hyaline tissues. The frequency of resin particles or globules is meager in the assemblage. Occurrence of rich

biodegraded terrestrial organic matter exhibits early burial decomposition of the plant biomass. The study further indicates thermal alteration of the material.

Rajni Tewari

Palynological investigations of samples from bore-hole 1008 of Manuguru area of Godavari Graben have revealed the presence of Early Triassic palynoassemblage dominated by taeniate disaccates, viz. *Lunatisporites* and cingulated cavate trilete spores, viz. *Lundbladispota* and *Densoisporites* along with other stratigraphically significant taxa, viz. *Chordasporites*, *Falcisporites*, *Kamthisaccites*, *Playfordiaspora* at 52 to 82.50 m depth. Maceration of samples from bore-hole 1007 of Manuguru area is in progress. Additionally, carried out processing of samples from bore-hole MMV-6 of Venkatpur area. Quantitative palynological analysis has been indicated Lower Barakar age for these sediments.

Neerja Jha & Pauline K. Sabina

The Lower Barakar (Early Permian) palynoflora showing dominance of non striate disaccates, chiefly *Scheuringipollenites*, have been demarcated in bore-holes MLG-23 and MLG-24 of Gundala area, Godavari Graben. Late Permian Raniganj palynoflora has also been identified in bore-hole MLG-23. This is the first report of occurrence of Late Permian Raniganj palynoflora in Gundala area.

Neerja Jha & Neha Goel

Thrust Area: FRONTIERS IN PALAEOBOTANICAL RESEARCH (Reconnaissance Projects to aid in development of future research direction)

Project 14.1: Carboniferous land plants in the Himalaya (Spiti): Phytogeographic and palaeogeographic implications

Around 40 megafossil specimens collected during 2008 from the sediments of the Kuling group (Permian) near Guling village and from the Carboniferous sediments exposed near Poh, Nadang, Tabo and Lari villages in the Kaza district of Spiti Valley have been processed, photographed and studied. The specimens are poorly preserved and identified as conifer axes with two kinds of organizations, axes with longitudinal striations, lycopod stems, *Triphyllopteris* sp., ?bryophytic thalli, and some seeds. We have not found any evidence of *Glossopteris*

flora in this collection.

Attempted for an excursion to Spiti area in Himachal Pradesh in September 2009, but could not reach the area because of the blockade of the roads between Kunjum La Pass and Kaza. Later, GKS visited the area and measured section up to 100 m and collected 62 samples for microfossil analysis. The samples of sandstone and shales have been macerated and some of them have yielded a few palynomorphs whose identification is in progress.



Triphyllopteris and a Brachiopod from the Carboniferous sequence of Spiti Valley

K.J. Singh & G.K. Singh [& S.K. Parcha (WIHG)]

A field trip has been undertaken to Kinnaur area, Himachal Pradesh to explore the possibility and collection of samples for palynological and megafloral studies. Visited Pangti, Akpa and nearby areas of Kalpa, Sangla and Tidong Valley in search of good sections and megafossils. The areas are tectonically highly deformed. few samples are collected from Moorang, Chitkul and

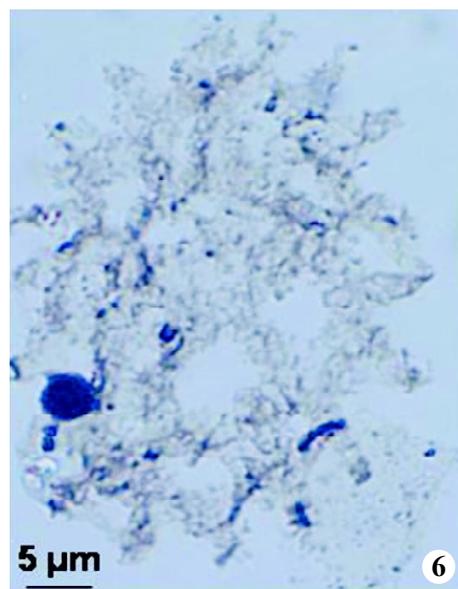
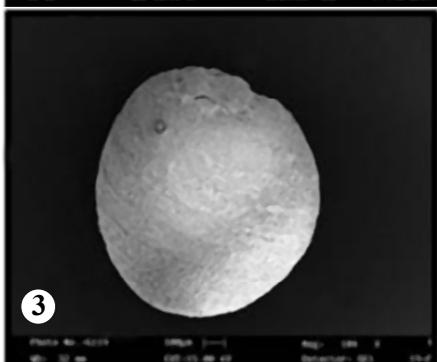
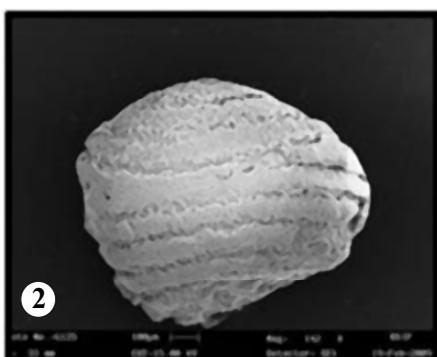
Thangi villages. Only pseudofossils are found in the Moorang (Devonian) Formation. Processing of 36 palynological samples from ahead of Sangla, Sangla base, Songtong bridge, Moorang road side, Moorang section and ahead of Thangi has been carried out for recovery of palynomorphs. No pollen and spores are recovered.

N.C. Mehrotra, Neerja Jha, Rajni Tewari, K.G. Mishra & G.K. Singh [& S.K. Parcha (WIHG)]

Project 14.2: Megaflora and Palynology of the Kargil Molasse

An assemblage of plant fossils represented by leaf impressions of angiosperms and pteridophytes, spores and pollen grains of pteridophytes, gymnosperms and angiosperms, algal and fungal remains, gyrogonites of charophytes has been recorded from the Kargil and Tharumsa formations belonging to Kargil Molasse Group of northwest Ladakh Himalaya. The palynomorphs derived from various lithofacies of Tharumsa Formation are composed of Late Cenozoic affinities along with rich reworked Gondwanic miospores of Late Permian

(Tatarian) and Early Triassic (Scythian) age. Quantitative analysis of reworked Gondwana palynomorphs has been finalized (jointly with Ram Awatar). Preponderance of reworked miospores is much significant in interpreting erosion, transportation and redeposition of pre-existing Late Permian to Late Triassic sediments situated far away from the depositional site of Tharumsa Formation. Dominance of *Striatriletes* (= *Ceratopteris*), algal coenobia of *Pediastrum*, zygospores of *Lecaniella* and gyrogonites of charophytes indicates a relatively high



1. Outcrop of the Kargil Formation, 2-3. SEM of gyrogonites of charophytes from the Kargil Formation, 4. Outcrop of the Tarumsa Formation, 5. Impression of dicot leaf from the Tarumsa Formation, 6. *Pediastrum* colony from the Tarumsa Formation

energy braided multichannel fluvial system with influence of enormous tectonic activity. From the Tharumsa Formation a very well preserved leaf impression of *Broussonetia* (Family Moraceae) and pollen grains of *Cedrus*, *Abies* and *Pinus* have been recorded that exhibit existence of high altitude (> 2500 m) flora and onset of temperate condition in the region during Miocene. The macro- and microfloral assemblages derived from Kargil and Tharumsa formations indicate subtropical to temperate vegetation with influence of moist and humid climate.

Additionally, a field excursion has been undertaken for the collection of rock samples from Hemis, Basgo, Upshi, Kiare and Chumathang localities of Leh area (Indus Valley) and Kargil, Tharumsa and Pashkyum localities in the Wakha River Section near Kargil area. All the outcrop sections are measured properly. The Late Oligocene Hemis Conglomerate Formation is well developed in the vicinity of Hemis Gonpa. The Hemis Formation is characterized by well bedded conglomerates with a clast supported texture. Impressions of wood

fragments/barks have been observed in the study area. Shale samples from these localities have also been collected for palynofacies analysis and studies on charophytes. The sediments of Basgo Formation near the Basgo Monastery and Taruche Village Section are also equivalent to Kargil Formation. The sandstone and shale samples of these areas are potential for the study of palynofacies analysis and charophytes. The fossil woods collected from here did not show any preservation and hence, appear to be cast. In addition, Kiare, Upshi and Chumathang areas of the Indus Group are also visited for the collection of rock samples. The Kargil Molasse Group, divided into Kargil, Tharumsa and Pashkyum formations, is composed mainly of sandstone, mudstone siliceous clay and gray to dark brown carbonaceous shale. A few plant mega-fossils as well as lacerated plant remains and potential shale samples/clays for charophytes and palynological analyses have been collected from the outcrops of Kargil, Tharumsa and Pashkyum formations.

R.C. Mehrotra, Madhav Kumar & AK Ghosh [& **Ashok Sahni** (Chandigarh) & **K. Kumar** (WIHG)]

Project 14.3: Chronology, Palaeobotany and Magnetostratigraphy of the Rajmahal Volcano-sedimentary Succession

Compiled the palaeofloral records recovered from the Intertrappean beds of the Rajmahal Basin. The palynoflora from the bed at Moti Jhama yielded long ranging taxa (*Araucariacites*, *Callilasporites*, *Podocarpidites*) occur from Jurassic to Early

Cretaceous. No significant age marker taxa could be observed. Hence precise age could not be defined.

Archana Tripathi (superannuated w.e.f. 31.07.2009) & **B.N. Jana** (superannuated w.e.f. 30.06.2009) [& **Kanchan Pande** (IITB) & **G.V.R. Prasad** (Jammu)]

Project 14.4: Neyveli lignites: Biostratigraphy and Palaeoecology

Analysis of samples from Mine-I and Mine-IA of Neyveli Lignite field, Tamil Nadu revealed a diversified assemblage of palynomorphs along with rich and varied organic matter. Significant palynotaxa in the assemblage are— *Proxapertites*, *Palmaepollenites*, *Dorrenipites*, *Marginipollis*, *Dermatobrevicolporites*, *Lanagiopollis*, *Tribrevicolporites*, *Retitrescolpites*, *Meliapollis*, *Rhoipites*, *Dipterocarpuspollenites*, *Cruciferoipollenites* *Ctenolophonidites* and

Clavaperiporites, indicating Early to Middle Eocene age and coastal environment of deposition. In addition, documentation of palynological assemblages from Neyveli lignite mine continued, besides finalization of manuscript dealing with Eocene age marker dinoflagellate cysts and spores-pollen recovered from Mine I.

Rahul Garg & M.R. Rao [& **Ashok Sahni** (Chandigarh) & **R. Nagendra** (Anna Univ, Chennai)]

Additional Research Contributions

A well documented assemblage of Bhima macrofossils comprising *Chuaria*, *Tawuia*, *Protoarenicola* and allied remains has been subjected to CLSM and RSA studies. Attempt on Bhima macrofossils has revealed dark grey-black and white regions, often containing some degree of banding. This banding possibly represents the fine layered structures observed in cyanobacterial mats. In this scenario, it is interpreted that the darker layer consisted of bio-films of fossilized micro-organisms and the lighter regions the sedimentary grains that are trapped and cemented by the organic material. This theory is, to a degree, supported by the Raman Spectra collected on the samples. While the lighter areas generally fluoresced during Raman Analysis, their chemical make-up hence proving inconclusive, carbon spectra were obtained from the darker areas, consistent with an organic origin. Small differences in the Carbon spectra represent structural changes between the graphitic and disordered content.

Mukund Sharma

Finalized a paper on the 17 organic-walled microfossil taxa (Chroococaceae, Entophysalidaceae and Oscillatoriaceae) from the coated grains bearing carbonate facies of Nagod Limestone Formation belonging to Bhandar Group, Vindhyan Supergroup exposed in and around Sijahata village of Satna district in Madhya Pradesh. These taxa represent unique properties of auto-transformational phase for their survival according to environment for the sediment deposits.

V.K. Singh & Rupendra Babu

Mixed floral elements of northern and southern floras of Late Paleozoic have been examined in detail and it is suggested that in all probability so called elements of mixed flora had their ancestry or affiliation with Carboniferous floras and during the Early Permian they doomed due to severity of climatic conditions, but developed again during Late Permian, when climate became more hospitable for their development. The Cathaysian and Euramerian forms discovered with Gondwana forms in the mixed floras of Tethyan region, i.e. Hazro, Saudi Arabia, New Guinea, Oman, Jordan, Kashmir, central Tibet and southern Tibet belong to middle and upper Permian sequences, and during this time the warm humid and temperate climate helped to revive the

northern hemispheric forms which had their endurance in a relatively similar climate of the Late Carboniferous. The morphological conservatism/flexibility, radiation, relationship and analogous features of mixed floral elements have been examined and attempts are made to sort out their disputed presence in different floral provinces.

A.K. Srivastava & Deepa Agnihotri

Bennettitales were a group of extinct seed plants characterized by pinnately compound crown of leaves occur on top of the stem gives superficial resemblance with Cycads. These plants constitute major part of the Mesozoic vegetation. The morphological variations, i.e. simple to compound leaves are apparent in Mesozoic fossil records of Indian Gondwana. It is observed that the simple leaf (*Nilssoniopteris*) is the ancestral form is maintained in ontogeny while leaflets of compound leaves were developed gradually by subdivision and suppression of simple laminas. Furthermore advancement is visible through reduction in size of the pinnae (*Otozamites*), whereas longitudinal differentiation is also apparent in *Ptilophyllum* along with catadromic and anadromic fusion of bases of various pinnae, exhibit morphological variations among bennettitalean fronds.

The Mesozoic flora of Iran is significant in understanding the plant evolution and depicting geological history and palaeogeographic implications. Geodynamic interaction of Eurasian continental margin and the Tethyan ocean belt played an important role in the deposition of Mesozoic sediments, particularly Upper Triassic-Jurassic sequences of Alborz Basin (Iran). Palaeobotanical data of Shemshak Formation bear a clue to solve stratigraphic controversy raised by faunal and geological evidences. The deposition of Shemshak Formation in Alborz was also influenced by tectonic factors which resulted in deposition of sub-continental coal bearing facies holding plant relics. The assemblage includes number of plant fossils of Pteridophyte (*Todites*), Bennettitales (number of species of *Ptilophyllum* and *Pterophyllum*) and Coniferales (species of *Elatocladus* and *Pagiophyllum*) and is dominated by Bennettitales and Coniferales while Pteridophytes are meagre. Detailed comparison of flora shows its Laurasian and Gondwanan affinity.

Neeru Prakash

Finalized the palynoassemblage data comprising fungal-pteridophytic spores, gymnosperm and angiosperm pollen from an exposed section (Lower Siwalik) on Nahan Ponta-Saheb road, Himachal Pradesh. The qualitative and quantitative analyses revealed that the fungal spores dominate over pteridophytes followed by gymnosperms and angiosperms. Algal remains are feeble in number. On the basis of their affinities with modern equivalents, a humid tropical to subtropical climate has been indicated during the deposition of sediments. Based on the above observations a fresh water environment has been assessed for Lower Siwalik sediments in this area.

Mahesh Prasad, E.G. Khare & S.K. Singh

The plant mega fossils so far recovered from the Late Tertiary sediments of Mahuadanr Valley have been analysed and an attempt has been made to deduce palaeoclimate and phytogeography of the region during the period. From the present-day distribution of the comparable species of the fossils, it is concluded that most of the comparable species of the fossil assemblage are found at present in the vicinity of the fossil locality indicating that almost same flora has been persisting since sedimentation and that there has been no remarkable climatic change in the area since Late Tertiary time. The habit and habitat of the fossil comparable taxa also indicate that a tropical deciduous forest was flourishing in and around the Mahuadanr Valley during sedimentation.

A study based on the fossil leaf assemblage collected from the Upper Tertiary sediments of the valley revealed the occurrence of two new taxa— *Ziziphus funiculosa* and *Lagerstroemia macrocarpa* of the family Rhamnaceae and Lythraceae, respectively. Present day distribution of these modern comparable species of the fossils indicates that both the taxa are presently distributed in the moist deciduous forests of the north-east, central and south India. This finding suggests that moist deciduous type of forest was flourishing in and around the fossil locality during the sedimentation.

Mahesh Prasad & S.K. Singh

A paper dealing with the three proposals to amend the International Code of Botanical Nomenclature (ICBN) has been finalized. Another paper dealing with the replacement names of 5 homonyms and validation of 8 species names of fossil fungal taxa has also been finalized.

R.K. Saxena

A book, including synopsis of all published work on Indian Tertiary Palynology, has been prepared and is being finalized. In addition, a monograph on Indian fossil fungi, including all fossil fungal taxa known so far, is being prepared.

R.K. Saxena & S.K.M. Tripathi

A paper dealing with the palynological study of the Lower Siwalik sediments exposed at Koilabas area, western Nepal has been finalized. The recovered palynoflora is represented by algal and fungal remains, pteridophytic spores, gymnosperm and angiosperm pollen grains. The assemblage is dominated by gymnospermous pollen grains followed by pteridophytic spores/fungal remains and angiosperms. The important palynoflora recorded are *Zygnema*, *Botryococcus*, *Lygodiumsporites*, *Lycopodiumsporites*, *Hammenisporis*, *Inaperturopollenites*, *Tsugapollenites*, *Pinuspollenites*, *Abiespollenites*, *Piceapollenites*, *Tricolpites*, *Retistephanocolpites* and *Graminidites*. On the basis of their affinities with modern equivalents, a warm and humid tropical-subtropical climate has been inferred during the deposition of sediments. The sequence of Lower Churia Formation in Koilabas area was deposited in wet, open and mixed grassland. Algal remains of *Zygnema* and megaspores of *Botryococcus* provide cogent evidence for this inference.

M.R. Rao, Mahesh Prasad & E.G. Khare

Palynological studies on 44 rock samples collected from Tarkeshwar open-cast lignite mine, Surat district (Gujarat) have been carried out. The litho-section from which the collection has been made is represented by two lignite seams, the lower and upper seams being approximately 6 and 2 m thick and the intervening shale-clay unit, about 5 m thick. The constituent palynofloral elements recorded from the section are represented by algal cysts, fungal remains, pteridophytic spores and angiospermous pollen. Significant spore/pollen genera in the assemblage are— *Dandotiaspora*, *Lygodiumsporites*, *Todisporites*, *Biretisporites*, *Polypodiaceasporites*, *Arecipites*, *Palmaepollenites*, *Proxapertites*, *Longapertites*, *Spinizonocolpites*, *Acanthotricolpites*, *Margocolporites* and *Ctenolophonidites*. The assemblage is marked with prodigality of fungal remains, particularly the spores.

S.K.M. Tripathi & Hukam Singh

The distribution pattern of microscopic charcoal and other sedimentary organic matter (SOM) are analyzed in 8 sections belonging to Jabalpur Formation (Early Cretaceous), exposed around mine pit and river cuttings in South Rewa Basin (Madhya Pradesh). The charcoalified plant fragments indicate influence of thermal alteration of woods, leaves and other parts of the plants, are helpful in reconstruction of past fire events. The charcoal recovered from carbonaceous shale, clay, sandy clays are quantified to identify peaks of charcoal abundances representing fire episodes and its intensity, climate change, debris flow, their burial and preservation potential in the associated sediments. The other SOM (palynofacies) containing leaf fragments (cuticles and stomata), biodegraded terrestrial, amorphous, resins, spore-pollen and algal filaments are also provide valuable information in predicting depositional and burial processes before and after destroying vegetation through wild fire, transportation of post fire biomass by low energy fluvial sediments, and their deposition in various lakes. The variations in charcoal abundance in all sections located at different sites are correlated with each other depicting temporal and spatial scale of frequency resolution and severity of fire in standing vegetation at various sites in the regions during Early Cretaceous. The result derived from all charcoal rich beds also exhibit statistical data of charred, non-charred phytoclasts, various phases of biodegraded phytoclasts, etc., and environment of deposition of such plant derived organic particles. The spore-pollen taxa and palynofacies recorded from these beds provide vegetation, climate and preservation potential of Late Gondwana flora in the basin.

Madhav Kumar

A manuscript entitled 'Dinoflagellate cyst evidence for age of the Naredi Formation, southwestern Kutch' is finalized.

Rahul Garg, Khawaja Ateequzzaman & Vandana Prasad

A rich palynofloral assemblage has been recovered from the Lower and Middle Siwalik sediments exposed along the Thuligad-Purniyagiri road in Champawat district, Uttarakhand. Pteridophytic spores and gymnospermous pollen dominate the assemblage. The important palynotaxa in the Lower Siwalik subgroup sequence are: *Striatriletes susannae*, *Lygodiumsporites eocenicus*, *Poly-podiisporites* spp. and *Monolites* spp. Whereas *Pinuspollenites* spp, *Palmaepollenites* sp., *Tricolpites* sp. and *Monoporopollenites* sp. occur in the Middle Siwalik. Most of the samples have yielded rich fungal spores/conidia and ascostromata throughout the

succession. The palynoflora indicates a tropical-subtropical, warm-humid climate with heavy precipitation during the sedimentation of the Lower and Middle Siwalik sediments in the studied area.

Samir Sarkar & Mahesh Prasad

Work on the diversity, growth-form analysis, taphonomy and palaeoecological implications of Corallanicean red algae and Halimedacean green algae from the Prang Limestone Formation of South Shillong Plateau have been completed, and the manuscript has been finalized.

A.K. Ghosh

Compiled data on macerals (both under normal and fluorescence modes) in Indian Permian Gondwana coals and discussed their significance in relation to economic aspects. Though these coals are investigated extensively and intensively, some still need to be studied in detail especially under fluorescence mode. It is evident that future investigations should be directed to ascertain chemical and physical factors causing fluorescence properties. Mineral inclusions in coals also need to be properly characterized for ascertaining the specific utilization potential of coals. Coalbed methane related data, especially the micro-cleat, are prime requisite in current scenario.

Discussed coal petrological data (macerals and rank) accumulated from the well-explored Hura (representing seams I-IV), Chuperbhita (seams I-VIII) and Pachwara (seams I-IX) coalfields of the Rajmahal Basin. On the basis of coal types, it appears that coal seams have originated dominantly from mixed- to *in situ* vegetation. Study also indicates rapid seasonal fluctuations with wet-reducing (anaerobic: vitrinite-rich) to dry-oxidative (aerobic: inertinite-rich) conditions; deposited under the influence of brackish water conditions.

Alpana Singh & B.D. Singh

Various sections of Swang, Kathara, Kargali and Karo groups of seams have been plotted depicting their relationship in the East Bokaro Basin. Central part of the basin particularly around Lugu Hill shows more promising for coal bed methane resources as it represents the deepest part of Bokaro Basin. Micropetrographic studies, which is not yet on the record would throw more light in better understanding of CBM potential in the area. New collections would be made from the area for further studies. (work is for Ph.D thesis of Mr. Ankur Kumar, Lucknow University).

A detailed study of liptinite group of macerals viz., sporinite, resinite, alginite, etc. under normal and fluorescence are taken up for their assessment in the lignites. Typical subernites are recorded in the Neyveli lignites. (work is for Ph.D thesis of Ms. Komal Verma, Lucknow University).

The coal and lignite petrological data from different basins of India are processed for coal bed methane resource characterization, and a lecture was prepared 'Know thy Coal'.

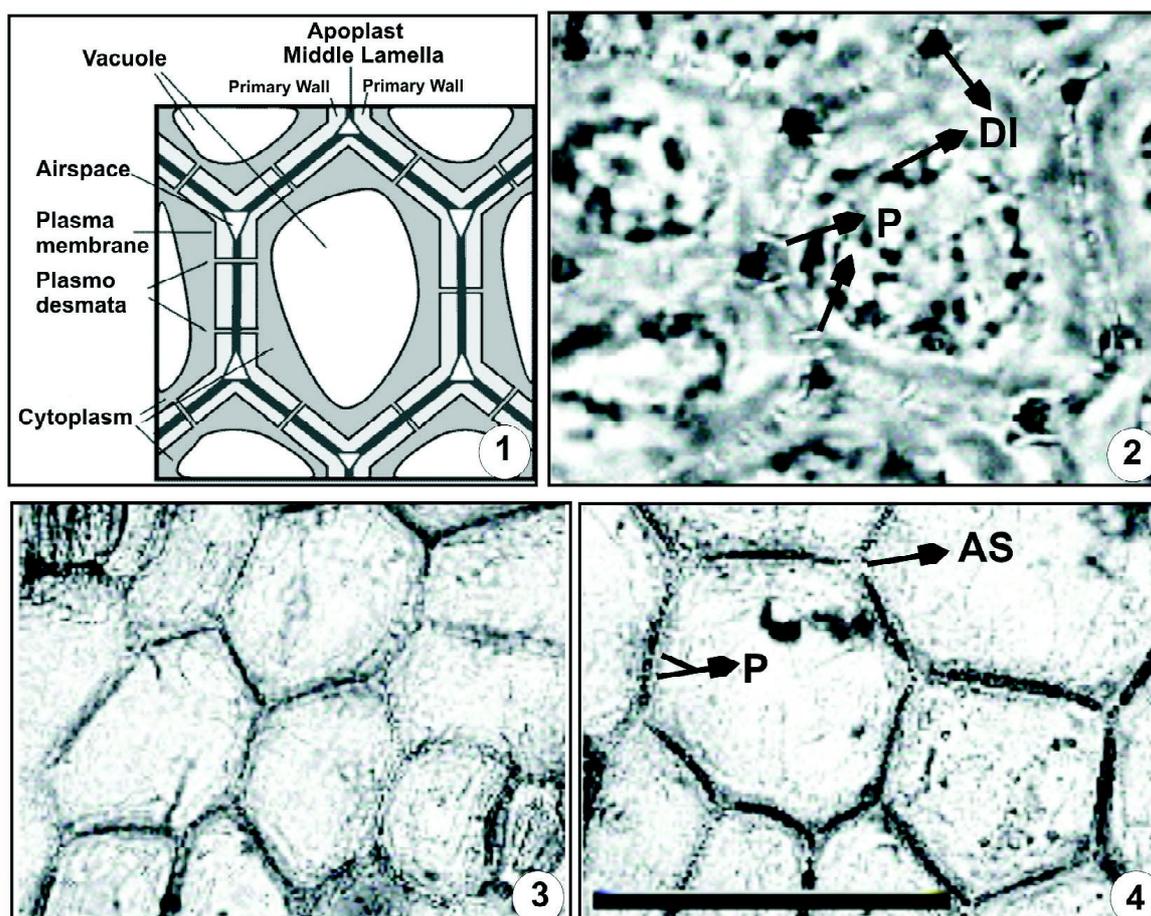
Rakesh Saxena

Palynological study in three trench and core samples collected from Lalitpur district (Uttar Pradesh) has been finalized. Besides, leaf epidermal characteristic features of coastal halophytic plant *Suaeda maritima*, *S. monoica* and *S. nudiflora* and its Na/K ratio in foliar tissues is studied.

Anjum Farooqui

Pollen composition of two honey samples from Gundal Dam and BR Hills, Chamaraja Nagar district (Karnataka) has demonstrated the abundance of *Ageratum conyzoides* and *Pongamia* sp. pollen at the tune of 75% and 73% respectively. Therefore, both the plants are the chief sources of nectar flow in their respective area and hence the honeys are of monofloral nature. Others such as *Syzygium*, *Terminalia*, *Acacia*, *Grewia*, *Feronia lemonia*, *Caesalpinia*, *Moringa*, *Mimosa pudica*, *Prosopis*, etc. serve secondary sources of nectar as indicated by their sporadic pollen, whereas the pollen of anemophilous plants viz., Poaceae, Cyperaceae, etc. got either trapped in the hives incidentally by winds or inadvertently transported by the bees.

M.S. Chauhan & Srikanta Murthy



Leaf Epidermal Cell structure (1) and its morphology in *Suaeda nudiflora* (2-P-Plasmodesmata; DI-depositional inclusions of salts in air spaces/vacuoles), *S. monoica* (3) and *S. maritima* (4). While the former is resistant to high coastal salinity due to suaedoid type of morphology, the latter two are susceptible/sensitive due to austrobassoid type of morphology. The expanse and dominance of *S. nudiflora* in the south-east coastal areas since the last decade indicates the increase in salinity.



Carried out palaeontological investigation of European moss cushion in order to segregate plants growing hidden underneath the ground layer. Obtained specimens show unbranched-branched fleshy thalli and enlarged calyptra which protects the sporophyte. Palynological investigation has shown that spores remain adherent in their tetrad after maturity, cryptopolar type, showing irregularly reticulate sculpturing at exposed surface (i.e. distal) which under SEM exhibits double ornamentation. Prepared a paper on the aspect (with a distribution-map and photoplate) providing its detailed account and applications.

Asha Gupta

Twenty-five modern moss and subsurface soil samples have been pollen analyzed to assess pollen/vegetation relationship from Tura peak reserve forest of West Garo Hills, Meghalaya. The first comprehensive study has reflected predominance of nonarboreals over arboreals, signifying the existence of deciduous open lowland forest. The occurrence of high land exotic plants is suggestive of long distance transportation of pollen through upthermic wind. The abundance of both monolete and trilete fern spores along with fungal remains especially Microthyriaceae, *Xylaria*, *Nigrospora*, *Cookeina* and *Pleospora* are suggestive of humid depositional condition. A 9,660 yrs of pollen record from 1.30 m sedimentary profile of Garobadha swamp, West Garo Hills has also been traced. The present investigation has documented a vegetation succession under three different climatic regimes viz., onset warm and humid, increasing warm and humid and warm and dry climatic condition since late Holocene.

S.K. Basumatary & S.K. Bera

Co-supervised M.Sc dissertation of Mr. Yub Raj Dhakal, CDES/Tribhuvan University, Nepal entitled 'Forest ecology and tree-ring pattern at the treeline of Langtang National Park, Rasuwa, Nepal Himalaya'.

S.K. Shah

Received about fifty-nine bags of soil samples collected through recent excavations during 2007-2009 by the Department of History and Archaeology, Nagaland University, Kohima for archaeobotanical remains for the first time in archaeological context of Nagaland. The retrieval of botanical remains by water floatation technique has been carried out. Preliminary investigations brought to light the components of pre- and post-metallic plant economy in the eastern region. It is expected that the results would open new perspectives and problem

areas for future research to fully understand the subsistence strategies that evolved in eastern India.

A.K. Pokharia

In the process of Geochemical Laboratory establishment in the institute, the sample digestion facility for wet chemical analysis using ICP-AES/MS is made functional. Recently, the international as well as national rock/sediment reference material has been procured which would reduce the visiting time to national laboratories for the analysis.

Anupam Sharma

The joint work with several other groups from within and outside Institute is being pursued on palaeoclimatic and archaeological problems connected through radiocarbon and geochemical measurements. They include researchers from Aligarh Muslim University (Indor Khera site), Gujarat Ecological and Environmental Research Foundation, Gandhi Nagar (coral samples for their growth study), Indian Institute of Science (Makran samples for Tsunami signatures) and University of Lucknow (archaeological samples from Kushana period). The joint work with WIHG, Dehradun, HNBGU, Srinagar, NGRI, Hyderabad and PRL, Ahmedabad on archaeological and sedimentary samples has been finalized and submitted. A coral samples from off-coast Jam Nagar is also dated taking 3 parts from different growth stages to estimate growth rates. Manuscripts submitted to an encyclopedia (by Sage, USA), and papers on joint work are revised.

C.M. Nautiyal

Dispersed fossil plant cuticles from Tertiary of north-east India, viz. Upper Siwalik sediments of West Kameng district, Arunachal Pradesh, Barail sediments of Makum and Dilli-Jeypore coalfields, Assam and from near Champhai, Mizoram have been reviewed. An assessment of the cuticles indicates existence of a rich and diversified angiospermous flora in Jeypore and Makum coalfields. An analysis of the structural characters of the cuticles reveals both mesomorphic and xeromorphic features, indicating a warm tropical climate with high precipitation and a marshy habitat.

Rajni Tewari & N.C. Mehrotra

An occurrence of the ichnogenus *Teredolites* associated with the body fossils of the causative teredinid bivalves (Mollusca) and the teredinid-infested fossil wood in the Early Eocene (~52-53 Ma) subsurface beds of the Cambay Formation at Vastan lignite mine (Surat district)

in western India, is described and illustrated. The extensively bored fragments of wood logs with borings of *Teredolites* are recovered from a grey shale horizon about one meter below the lignite seam -1 in the mine section. Three distinct size groups of borings overcrowd the wood logs leaving little woody material. The morphological characteristics of teredinid borings suggest the predominance of ichno species *Teredolites longissimus* Kelly and Bromely 1984. Morphology of the associated teredinid shell valves suggests that the bivalve responsible for borings in the wood was either a bankiine, e.g. *Bankia* or teredinine, e.g. *Teredo*. Variations observed in size of borings (trace fossils) and morphology of shells (body fossils) suggest involvement of more than one taxon of teredinids in producing *T. longissimus* borings from Vastan. A preliminary study of the associated xylic substrate material suggests its close affinity with woods of a modern tree genus *Aglaia* Lour. (Family Meliaceae), which presently occur in tropical and subtropical rain forests of the Indo-Malaysian region, Northern Australia and the Pacific. The teredinid-infested fossil wood was apparently transported from its natural habitat of an inland moist tropical forest to the nearby coastal region. A few more specimen study of Vastan teredolites is under progress.

Hukam Singh

A small collection of plant remains comprising fossil leaf impressions, silicified wood, spores and pollen grains is reported from the Vagadkhol Formation (Palaeocene-?Lower Eocene) exposed around Vagadkhol village in Bharuch district (Gujarat). The fossil leaves are represented by 5 genera and 6 species namely, *Polyalthia palaeosimiarum* (Annonaceae), *Acronychia siwalika* (Rutaceae), *Terminalia palaeocatapa* and *T.*

panandhroensis (Combretaceae), *Lagerstroemia patelii* (Lythraceae), and a new species, *Gardenia vagadkholia* (Family Rubiaceae). The lone fossil wood has been attributed to a new species, *Schleicheroxylon bharuchense* (Sapindaceae). The palynological assemblage, consisting mainly of pollen grains and some spores, is fairly diverse comprising 11 genera and species with more or less equal representation of gymnospermous and angiospermous taxa. All the fossil species have been identified in terms of the modern genera. The recorded fossil assemblages indicate terrestrial low land environment and mega fossil assemblages are suggestive of tropical evergreen to moist deciduous forest with sufficient humidity during the Palaeocene-?Eocene period. The presence of a good number of fungal taxa further suggests the prevalence of enough humidity at the time of sedimentation.

Recorded well preserved fossilized fruits from Lower Eocene lignite deposits of Vastan mine, near Surat (Gujarat). Fossil fruits of dicotyledonous plants having close affinity with modern taxa *Ziziphus xylopyros* (Rhamnaceae), *Combretum decandrum* Roxb. and *Terminalia chebula* Retz. (Combretaceae) and *Lagerstromia flosreginae* and *L. parviflora* (Lythraceae) have been collected. The fossils are referred to 4 new form species, namely *Z. eocenicus*, *C. vastanesis*, *T. cambaya* and *L. sahnii*. The habitat and present day distribution of extant comparable taxa suggest the prevalence of tropical deciduous forest with moisture-loving plants in the mine area during the Early Eocene period. Such deciduous forests presently occur in south Coimbatore, Palghat and moisture parts of the Mysore region of south India.

Hukam Singh, M. Prasad & S.K. Singh

Collaborative Work

Organized an *International Field workshop on Vindhyan Basin, Son Valley area, Central India* (January 20-31, 2010) sponsored by the Palaeontological Society of India, Lucknow and co-sponsored by the Birbal Sahni Institute of Palaeobotany.

Mukund Sharma [& PSI, Lucknow]

Finalized the MoU Report including palynological and petrological studies on the coal and associated sediments samples provided by GSI.

Archana Tripathi & Vijaya [under MOU between BSIP & GSI (Coal Wing)]

A manuscript on Late Holocene carbonised woods of Kerala has been revised as per reviewers suggestions.

J.S. Guleria & Rashmi Srivastava [& **A.B. Kumar & R. Satheesh** (School of Environmental Sciences, Mahatma Gandhi Univ., Kerala)]

Revised a manuscript on new developments in CLAMP: Calibration using global gridded meteorological data.

R.C. Mehrotra & G. Srivastava [& **Prof. R.A. Spicer, P.J. Valdes, T.E.V. Spicer, H.J. Craggs & J. Yang** (Open University, UK)]

Morphological study of Tertiary megafossils (leaf, stem and seed) procured from Pagladiya river bed, Baksha district, Assam has been completed.

R.C. Mehrotra, S.K. Basumatary, S.K. Bera, G. Srivastava, G.C. Sarma & C.K. Baruah (Gauhati University, Guwahati)]

The study of infected fossil roots of mangrove plant from Ratnagiri beds (Miocene) of Maharashtra has been initiated. Preparation of fossil slides as well as living counterpart has been done. Further work is in progress to study them for the presence of symbiotic fungi.

Rashmi Srivastava [& **David M. Kothamasi**, (Delhi University, Delhi)]

Palynological investigation of Coprolite from Late Pliocene (Tatrot Formation-Upper Siwaliks) Devni Khadri locality has been carried out. The organic content has been found to be very low. The assemblage consists of colonies of *Botryococcus braunii*, algal spores and one pollen belonging to *Retitrescolpites* (modern family Oleaceae). *Botryococcus* belongs to the family Botryococcaceae and it is an oil forming green alga. The representation of *Botryococcus* colonies indicate a freshwater environment.

M.R. Rao [& **Rajeev Patnaik** (Panjab Univ., Chandigarh)]

Palynological studies on early Eocene Matanomadh lignites from Kutch Basin have been undertaken. The palynofloral assemblage of the studied sequence comprised of pteridophytic spores, angiospermous pollen, dinoflagellate cysts and fungal remains. The assemblage is dominated by angiospermic pollen, particularly those having affinity with modern plants presently confined to tropical to subtropical areas. The assemblage is also rich in fungal remains. Many pteridophytic spores present in the assemblage are related with families Matoniaceae and Osmundaceae. Plants of these families grow in sub-aquatic to swampy habitats of tropical to subtropical areas. Other spores show affinity with ferns that also grow in similar climatic zones. The assemblage shows rich representation of pollen having affinity with the family Arecaceae. These have been ascribed to different species of *Spinizonocolpites*, and clearly indicate coastal environment. High morphological diversity in fossil *Nypa*-like pollen is amply exhibited in palynological assemblages indicating that plants producing these pollen inhabited more variable ecological conditions. Other pollen present in the assemblage bear affinity with plants which were the inhabitants of tropical rain forests. Abundance of fungal remains in the assemblage also suggests a warm and humid climate with high precipitation. The palynoflora indicates late Palaeocene to early Eocene age to the studied sequence.

S.K.M. Tripathi [& **Runcie P. Mathews** (IIT Bombay, Mumbai)]

Palynological studies and bulk organic geochemistry from Early Palaeogene sequence exposed in an open-cast mine located near Vastan, Gujarat have been finalized. The rock strata are referred to as Cambay Formation and are located in extreme western part of India. The studied section is 30 m thick and is constituted by shale, clay, marls and lignite beds. Palynoflora constituted by pteridophytic spores, angiospermous pollen, dinoflagellate cysts and fungal remains have been recorded. The assemblage is dominated by angiospermous pollen, of which, those having affinity with the family Bombacaceae and Arecaceae are most abundant. Most of the palynotaxa are related to plants or families presently confined within tropical to subtropical areas. Based on the palynological assemblage, the studied sequence is divided into two palynozones. Occurrence of marker dinoflagellate genera suggests that large part of the sequence is of latest Palaeocene age while the upper part is Ypresian in age.



The total organic carbon (TOC) content of lignites ranges from 37.44 to 74.81%, whereas the TOC content of the associated carbonaceous shales ranges from 0.87 to 7.36%. Hydrogen indices derived from Rock-Eval pyrolysis of the studied sequence vary between 11 to 385 mg HC/g TOC. Rock-Eval T_{max} reflects that the sediments are thermally immature. The present study suggests that the lignites and associated carbonaceous shales have mixed oil and gas-generating potential.

S.K.M. Tripathi [& S. Dutta & M. Mallick]
(IIT Bombay, Mumbai)]

A manuscript entitled '*Birbalodinium* gen. nov., a new peridinioid fresh water dinoflagellate cyst from Late Cretaceous (Maastrichtian) intertrappean sediments of Central India' is finalized.

Rahul Garg & Khawaja Ateeqzaman
[& Bandana Samant (BHU, Varanasi)]

A manuscript on palynological and palynofacies investigations of the early Palaeogene succession of the Vastan lignite mine with sedimentological interpretations for depositional environments in a coastal marine setup is prepared. The integrated dataset is utilized to reconstruct relative sea level changes and transgressive- regressive cycles within a firm biostratigraphic framework.

Vandana Prasad & Rahul Garg [& I.B. Singh]
(Lucknow University)]

Work is under progress dealing with nannofossil data of K/T section of Cauvery Basin with isotopic studies. Nannofossil documentation from sediments containing dinosaurian egg shell nestling site in Kallamendu Formation of Ariyalur area, Tiruchirapalli district is carried out. The nannofossil assemblage contains dominance of latest Maastrichtian age nannofossils with abundant holococcoliths indicating latest Maastrichtian age control. Abundance of holococcoliths indicates nearness to shore and one specimen of *Biantholithus* cf. *B. sparsus*? denoting earliest Danian age is also found.

Jyotsana Rai [& Mu. RamKumar]
(Periyar University, Salem)]

An integrated ammonite-nannofossil studies in the Mesozoic succession of Jaisalmer Basin, a sequence stratigraphic framework is under progress. Besides, a manuscript entitled 'Early to Middle Albian age calcareous nannofossils from Pariwar Formation of Jaisalmer Basin, Rajasthan, western India and its significance' is under preparation.

Jyotsana Rai & Abha Singh [& D.K. Pandey] (Univ. of Rajasthan, Jaipur)]

Detailed morphotaxonomic study of the recovered palynofossils from a measured stratigraphic section of Havelock Island, Andaman Islands viz., Kalapathar section has been carried out. The recovered palynofloral assemblage is mainly composed of angiosperm and gymnosperm pollen, pteridophytic spores, fungal spores and ascostromata, algal zygosporae and diatoms, suggesting an Early Miocene age to the assemblage. The palynoflora has been compared with modern equivalents and it indicates a subtropical humid climate with high degree of rainfall during the deposition of the sequence in studied area.

Samir Sarkar (& V. Sharma] (Delhi University, New Delhi)]

A rich palynofloral assemblage has been recovered from the Barsara Section of Kasauli Formation exposed near Sarahan, Sirmour district (HP). It consists of 8 genera assignable to 8 species of fungal remains, pteridophytic spores, gymnospermous and angiospermous pollen. The palynofloral assemblage comprising of palm pollen along with pteridophytes and other gymnospermous pollen from the section suggests coastal to fresh water environment for the deposition of Kasauli Formation at Barsara and the dominance of fungal remains suggests warm and humid climate during its sedimentation. Palynofacies analysis of these sediments reveals the dominance of black debris in the lower part of the formation and suggests the prevalence of oxidising conditions in the basin during its sedimentation. The palynofacies analysis of the upper part however, shows dominance of grey amorphous organic matter suggesting reducing conditions during the deposition. The thermal alteration studies based on visual estimation indicate the Thermal Alteration Index values calculated for the samples from Kasauli Formation of the Barsara section range from 2.5-3.0, which point out to excellent maturation for the generation of liquid hydrocarbons in the Kasauli Formation of the area.

Samir Sarkar & O.P.Thakur [& N.N. Dogra] (Kurukshetra University)]

The Kopili Formation is mainly characterized by alteration of sandstone and shales. However, in and around the Nongkhleig Village of Jaintia hills a highly fossiliferous limestone band (1-1.5m) has been encountered in the lower part. Both smaller and larger foraminifers, characteristic of Upper Eocene age is present in this limestone. For the first time corallinacean red algae have been recorded from the Kopili Formation. The assemblage is represented by *Spongites* sp., *Lithoporella melobesioides*, *Lithothamnion* sp., and *Melobesioideae* gen et. species indet. Majority of the forms are encrusting with the foraminifers as observed in thin section analysis.



A draft manuscript has been finalized on the above findings.

A.K. Ghosh [& Ajanta Sarma] (G.C. College, Silchar, Assam)]

A manuscript has been finalized on fresh water diatoms and desmids collected from the Burdwan District of West Bengal. Taxonomic analysis based on light microscopic as well as SEM observations have been incorporated in this study. Interpretation on the ecological perspectives on the algal assemblage has been made.

A.K. Ghosh [& J.P. Keshri] (University of Burdwan, WB)]

The selective resin material from Ratnagiri area for the organic geochemical characterization of South Indian lignite are processed for FTIR and Pyrolysis GCMS studies. The work is under progress.

Rakesh Saxena [& S. Dutta & associate] (IIT Bombay, Mumbai)]

Completed the maceral study and reflectance analysis of 21 coal samples from bore-hole GVV-6, Vadlagudem block, Godavari Valley Coalfield, Khammam district (Andhra Pradesh) and submitted a detailed report of the same.

O.S. Sarate [under MOU between BSIP & GSI (Coal Wing)]

Finalized the report on petrological studies (maceral contents with photoplates and rank data determined through vitrinite reflectance) of coals from Tatapani-Ramkola (29 samples from bore-hole TRBD-3) and Sohagpur (3 samples from bore-hole SCP-9) coalfields.

B.D. Singh & Alpana Singh [under MOU between BSIP & GSI (Coal Wing)]

A combination of petrological, palynological, elemental, Rock-Eval pyrolysis, Cury-Gas Chromatography-Mass Spectrometry, and FTIR spectroscopic techniques has been applied for detailed characterization of Tertiary Matanomadh lignites (Gujarat). It is evident from Rock-Eval T_{max} and VR_o data that the studied lignites have attained 'lignitic' stage/rank (ASTM) and fall in the early diagenetic zone of methane generation. High hydrogen index (HI) as evidenced by Rock-Eval pyrolysis and high content of hydrogen-rich macerals (perhydrous vitrinite + liptinites) determined through fluorescence microscopy are in accordance with each other. High TOC content and presence of mixed Type II/ III kerogen suggest that the lignite-bearing sequence has the potential to generate both oil and gaseous hydrocarbons on maturation.

B.D. Singh & Alpana Singh [& S. Dutta & others] (IIT Bombay, Mumbai)]

Pollen records from 1.2 m deep profile from Ropanchhapra Tal, Deoria district (Uttar Pradesh) have divulged that between 1350 and 600 yrs BP open grassland vegetation with sprinkle of trees viz., *Holoptelea*, *Symplocos*, *Acacia*, etc. occurred in the region under a dry climate with moderate monsoon rainfall. The presence of aquatic plants implies the existence of lake. The retrieval of Cerealia and other culture pollen taxa deciphers the agricultural activities in the region. From 425 yrs BP onwards the expansion of grasses and a corresponding sharp reduction in trees signify the initiation of relatively drier climate owing to reduced monsoon rainfall. The agricultural practice continued with same magnitude as before.

M.S. Chauhan [& Anjali Trivedi] (Lucknow University, Lucknow)]

Carried out pollen analysis of 25 samples from a 50 cm deep sediment core from Sangari, Maharashtra. The pollen assemblage is characterized by the frequent record of *Madhuca indica* and Sapotaceae, whereas the other trees viz., *Acacia*, *Symplocos*, *Syzygium*, *Terminalia*, etc. are intermittently present. *Lepidagathis* and Acanthaceae are the common shrubs. The herbaceous complex shows the abundance of grasses, sedges, *Cheno/Am*, *Polygonum plebeium*, etc. In general, the vegetation composition is suggestive for the presence of open vegetation interspersed with patchy occurrence of forests. Retrieval of aquatic elements viz., *Typha*, *Potamogeton* and algal remains- *Zygnema*, *Spirogyra*, *Botryococcus*, etc. reflects the existence of lake.

M.S. Chauhan [& Y.B. Sharma] (University of Oxford, UK)]

The study of 10 squeezed honey samples, 5 each from Rangjuli and Agia reserve forest of Goalpara district, Assam, have been carried out. The majority of the honey samples are found to be bifloral dominated with *Brassica nigra*, *Coriandrum sativum*, *Shorea robusta*, *Salmalia malabaricum*, Myrtaceae associated with *Mimosa pudica*, *Terminalia bellerica* and *Syzygium cumunii*. Other reliable nectar sources for honey bee are also identified.

S.K. Bera, S.K. Basumatary & Swati Dixit [& G.C. Sarma & A. Rahman] (Gauhati University, Guwahati)]

Palynoassemblage recovered from 15 mud samples of Dhir beel, Dhubri district, Assam indicates the deterioration of the biodiversity in and around Dhir beel due to human activity and repeated flood episodes. The

evidence of low pollen frequency in high pH (>7.8) sediment suggest lower rate of pollen deposition.

S.K. Bera & S.K. Basumatary [& Munmun Brahma
(Science College, Kokrajhar, Assam)]

Interannual variations in cellulose oxygen isotopic composition ($d^{18}O$) of four teak (*Tectona grandis* L.F.) trees: one from western India, two from central India and one from southern India, are studied. Teak trees from central India that grew within ~25km of each other show a higher isotopic coherence than their ring-widths. Cellulose $d^{18}O$ of teaks from western and central India show a significant positive correlation with the amount of rainfall and rainfall reconstruction extends back to 1743 A.D.

A. Bhattacharyya & S.K. Shah [& S.R. Managave & R. Ramesh (PRL, Ahmedabad) **& M.S. Sheshshayee** (Univ. of Agricultural Science, Bangalore) **& H.P. Borgaonkar** (IITM, Pune)]

A field trip has been carried out during Nov.-Dec., 2009 in and around Shillong plateau, Meghalaya under INSA exchange program and subsurface sediments are collected from five sediment profiles for pollen analysis.

A. Bhattacharyya [& Pawel Prokop (IGSO, Polish Academy of Sciences, Krakow)]

A paper covering Late Quaternary climate changes around upper Baspa Valley, Kinnaur, Western Himalaya based on multi proxy viz., pollen, chemical (viz., Al, Fe, Mn, Ca, Mg, Ti, Na, K, Ba, Sr, Li, Cr, Co and Cu) and environmental geomagnetic parameters has been finalized.

A. Bhattacharyya, Jyoti Sharma, S.K. Shah & P.S. Ranhotra [& V.K. Banakar (NIO, Goa) **& N. Basavaiah** (IIG, Mumbai)]

The ongoing work in Spiti Valley was studied for their sedimentary architecture and chronological parameters. Deposition of fluvial and lacustrine deposits was linked to the climate and tectonics of the region and results will be finalized shortly.

Anupam Sharma & Binita Phartiyal [& P. Srivastava (WIHG, Dehradun)]

Aeolian sediments collected from the stabilized and active sand dunes from the Rajasthan region are analyzed for grain, size, mineralogy including heavy mineral study and geochemistry. It is established that the sediment shows signature of the Himalayan orogen and the sediment is differentiated texturally and chemically along the E-W wind trajectory. More work is under process.

Anupam Sharma [& Sudesh Yadav (JNU, Delhi)]

Morphotectonic analysis work has been carried out in the Spiti Valley using SRTM data for understanding tectonic and climatic perturbation.

Binita Phartiyal [& G.C. Kothiyari (ISR, Gandhinagar)]

Processed 16 samples from Swalbard, Arctic region for recovery of palynomorphs, but the samples are proved to be barren of spores and pollen.

Processed 10 samples from Permo-Carboniferous section (PC Section) for recovery of palynomorphs. The samples are poor in organic matter and proved to be barren of spores and pollen. PC Section, located at 78.96103° N: 11.69355° E, is >50 m thick with intercalations of conglomerate, sandstone and shale sequences. 20 samples were collected from the lower 40 m of the section.

N.C. Mehrotra, Neerja Jha, Anupam Sharma & Binita Phartiyal [& NCAOR (Goa)]

A paper is being finalized on the recovery of dark brown to black, polydeformed organic-walled microfossils (OWM) representing prokaryotes and vesicular forms (acritarchs) of variable in morphologies from the subsurface (drill bore core) semi-metamorphic rock samples collected from the Zangareddigudem area in the east of Chintalpudi sub-basin, Godavari Graben. Explored data on microfossils is preliminary and closely resembled with those known earlier reports in Latest Palaeoproterozoic strata found in Australia, China, Arizona and India. The comprehensive studies, both quantitative and qualitative of the recovered OWM indicate tidal environment and moderate deep marine water and also highly tectonic zone setting of this sub-basin.

N.C. Mehrotra, Neerja Jha, Rajni Tewari & Rupendra Babu [& M. Basavachari (SCCL, Kothagudam) **& V. Murugaiah, A.D.P. Rao & N.V. Sairam** (MECL)]

Compiled the palynological report with photoplates for the final report on the samples of Wardha-Godavari Basin.

Neerja Jha [under MOU between BSIP & GSI (Coal Wing)]

Comparative studies on *Glossopteris* and *Dicroidium* floras of Antarctica and India vis-à-vis palaeoclimatic implications are under progress.

Rajni Tewari [& Sankar Chatterjee (Texas Tech University, US)]

The anatomical study on the fossil woods collected from the Siwalik Tanakpur reveals the occurrence of 5 more taxa in the area. These are *Bauhinia malabarica*, *B. variegata*, *Millettia ovalifolia*, *Cynometra polyandra* and *Albizia lebbek* of the family Fabaceae.



The present habit and habitat of comparable species of recorded taxa shows that they occur in the tropical evergreen to moist deciduous forests of north-east and south India, Bangladesh, Myanmar, Malaya and adjoining areas which receive higher rainfall. Thus, it may be concluded that such forest was flourishing under warm humid climate in the vicinity of Tanakpur area in contrast to mixed deciduous forest there under reduced precipitation.

Mahesh Prasad [& M. Panjwani & Alok
(D.A.V. College, Kanpur)]

The investigation on the fossil leaf assemblage from Siwalik sediments of Darjeeling district revealed the occurrence of three new taxa in the area during Mio-Pliocene. The fossil taxa recorded here from the foothills near Sevok and Bagrakot show their close resemblance with the extant taxa, *Cananga odorata* Hook.f. & Th. (Anonaceae), *Pterospermum acerifolium* (L.) Willd. (Sterculiaceae) and *Paranephelium xestophyllum* Miq. (Sapindaceae). These are occurring now a days in the tropical evergreen to moist deciduous forests of north-east India, Myanmar and Malayan regions indicating the prevalence of warm and humid conditions during the deposition of these sediments in the area. Of these, *Cananga odorata* Hook. f. & Th. and *Paranephelium xestophyllum* Miq. are found to grow in Malayan region while *Pterospermum acerifolium* (L.) Willd. presently distributed in north-east India and Myanmar. This obviously suggests the exchange of floral elements between India and Malaya Peninsula through

Myanmar has been taken during Miocene period.

Mahesh Prasad [& M. Panjwani, A. K. Kannauzia & Alok
(D.A.V. College, Kanpur)]

A rich and well diverse amber embedded insects assemblages has been recorded from Vastan and Tarkeshwar Lignite mines of Surat district, Gujarat (Cambay Basin), and Matasukh Lignite mine of Nagaur district, Rajasthan (Nagaur Basin), Cambay. Amber occurs in lignitic and muddy sediments concentrated by near-shore chenier systems. It is a class II, cadinene-based polymer, which along with fossil wood anatomy indicates a definitive source of Dipterocarpaceae. The amber is very partially crosslinked and polymerized, and readily dissolves in organic solvents, thus allowing extraction of whole insects, whose cuticle retains microscopic fidelity. Fourteen orders and above 52 families and 100 species of arthropod inclusions have been discovered thus far, which show affinities to taxa from the Eocene of northern Europe but also to the Recent Australasia, and the Miocene of tropical America. A significant diversity of eusocial insects are fossilized, including corbiculate bees, rhinotermitid termites, and modern subfamilies of ants (Formicidae), groups that apparently radiated during the contemporaneous Eocene climatic optimum or just prior to it during the Palaeocene-Eocene Thermal maximum. Cambay amber preserves a uniquely diverse and early biota of a modern-type of broad-leaf tropical forest, revealing 50 Ma of stasis and change in biological communities of the dipterocarp primary forests that dominate southeastern Asia today.

Hukam Singh [& Scientists (from Germany, USA & from Srinagar, Chandigarh & Lucknow, India)]

Sponsored Projects

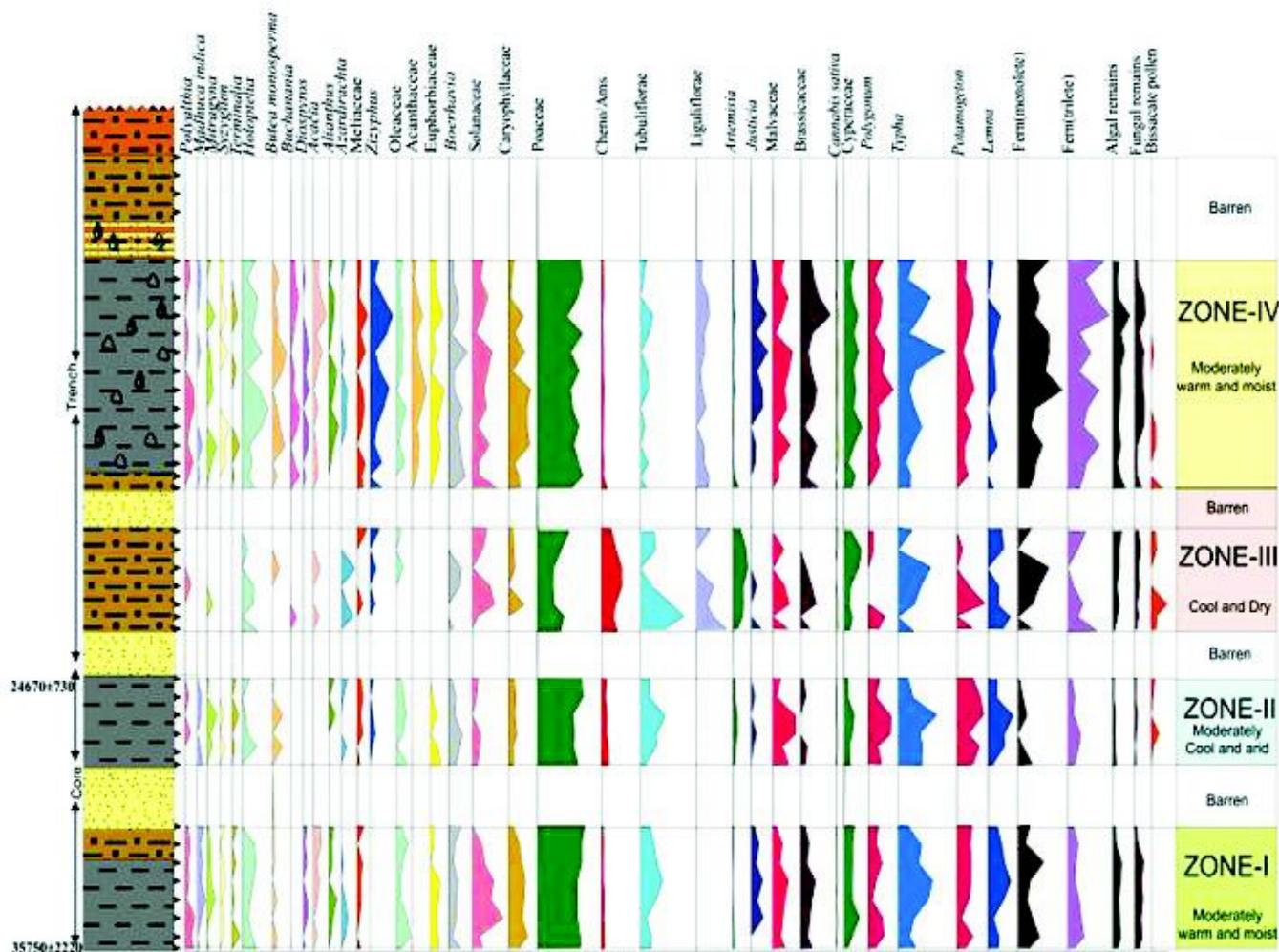
Project—Glacier morphology and Quaternary glacial history of Durung Drung Glacier, Zaskar, Ladakh, J&K State (Sponsored by DST, New Delhi, No. ESS/91/21/2003)

Finalization of progress report on climatic changes vis-à-vis glacial fluctuations based on pollen, environmental geomagnetic parameters (viz., Magnetic susceptibility, Induced Remanent Magnetization, Anhyseretic Remanent Magnetization, SIRM, S-ratio) and diatom from subsurface sediments of the area is in progress.

A. Bhattacharyya, Jyoti Sharma & Jyoti Verma

Project—Analysis of palaeovegetation and palaeoclimate of hominin bearing Quaternary sediments of central Narmada Valley, M.P. (Sponsored by DST, New Delhi, No. SR/S4/ES/138/2005)

Pollen analysis of a 2.60 m sediment profile from Khidiaghat (22°50'55.7''N: 77°55'55''E) located near Hathnora, Sehore district has been done. The pollen diagram of the profile has been divided in to 4 distinct pollen zones (KG-I to KG-IV from bottom to top) on the basis of fluctuations in the values of some prominent arboreal and non-arboreal taxa. The pollen zone KG-I exhibits the record of arboreal taxa, viz. *Madhuca*



Pollen diagram of Khidiaghat profile near Hathnora, Sehore District, Madhya Pradesh

indica, *Mitragyna*, *Syzygium*, *Terminalia*, *Holoptelea*, *Diospyros*, *Acacia* and *Meliaceae*. Shrubs are referable to *Oleaceae* and *Euphorbiaceae*. Herbs are represented by *Poaceae*, *Chenopodiaceae/Amaranthaceae*, *Boerhavia*, *Artemisia*, *Justicia*, *Cannabis sativa*, *Malvaceae* and *Brassicaceae* with some sedges suggesting the tree savannah type of vegetation flourished in warm and humid climate. The pollen zone KG-II shows the disappearance of *Madhuca indica*, *Diospyros*, *Alianthus* and also decreased frequencies of other trees and shrubs. Increased frequencies of terrestrial, marshy and aquatic herbs designate sparse tree savannah type of vegetation, suggesting of moderately warm and moist climate. The pollen zone KG- III reveals the depletion of trees and the vegetation comprises of grasses, *Chenopodiaceae/Amaranthaceae* and *Asteraceae* along with sparsely distributed trees, viz. *Holoptelea*, *Azardirachta*, *Zizyphus* and *Acacia*. The marshy elements comprise of sedges (*Cyperaceae*) and *Polygonum* with some aquatic elements, viz. *Potamogeton*, *Lemna* and *Typha*. The algal spores (*Spirogyra*, *Zygnema* and *Pediastrum*) have also been recorded. The overall vegetation assemblage is suggestive of the prevalence of a cool and dry climate regime during the period of sediment deposition. This vegetation scenario and corresponding climatic event is equivalent to the Last Glacial Maximum episode which has been globally documented between 18,000 to 22,000 yrs BP. The pollen zone KG-IV display the increase of total vegetation such as trees, herbs, shrubs and aquatic elements indicating proliferation of vegetation into tree savannah type and suggest moderately warm and moist climate.

The profile has also recorded *Chara* (Charophyta), *Ilyocypris* sp., *Candona* sp., (Ostrococha), *Gyraulus* sp., (Gastropoda) and some cyprinid fish scales indicating deposition in a swampy condition. The results of the present study have been compared with the profile of Late Pleistocene sediments (Baneta Formation) exposed at Hathnora and found. Both are correlatable. The project has been completed and finalized the project completion report.

M.R. Rao & Poonam Verma

Project—Quaternary sedimentary records of Baroda Window, Mainland Gujarat: A multidisciplinary approach (Sponsored by DST, New Delhi, No. SR/S4/ES-21/ Baroda Window/P1/ 2005)

A 1.1 m trench from a dried up lake from the Dhaddar river catchment is sampled on centimeter scale

and subjected to multiproxy study. Based on palynology, phytolith, sediment texture, clay mineralogy, environmental magnetism and isotopic data with chronological details, it is clear that during mid Holocene to late Holocene, the initial good hydrological conditions supported by the winter precipitation was deteriorated in the later part probably resulted into migration of the Harappan community. Further, the climate became more or less similar to present day, supported by SW monsoon. The fine tuning of the data is in progress.

The phytoplankton bearing water samples collected during last years's field work have been identified and their abundance is showing very good positive correlation with salinity, temperature and total dissolved solids (TDS). The cation and anion including other trace metals are also analyzed. The chemistry is compared with other central rivers and it is observed that the central Indian river, draining partially on the Deccan traps have higher ionic concentration as compared to Himalayan and peninsular rivers. As the basaltic rocks are vulnerable to surface conditions, the weathering is much more intense in these parts that resulted into high concentration of ions in the surface water.

In the entire Mahi river basin, 64 water samples collected from the entire stretch of Mahi river along with its major tributaries and few ground water and pond/lake waters. It is observed that at places ground water has more ionic concentration than the surface water. There are couple of sites where fluoride content is also higher than the permissible limits and because of this the fluorosis problem particularly the teeth decay and decoloration is easily noticeable. In the entire region of lower Mahi basin, the top cover is of aeolian nature, however it is established only on the geomorphological and textural analysis. To locate their source, samples were collected from multiple locations (~20 in number) and analysed for heavy mineral content as well as for geochemical characteristics. Our data suggest a mixed source for the sediment. Besides, data is also generated on mid-late Quaternary sections at various locations. Multiproxy data generation is in progress. On the basis of our data, distinct palaeoclimatic and environmental changes during the deposition is marked. The chronology has to be established for final interpretation. Work is in progress.

Anupam Sharma, S. Chakraborty, Vandana Prasad,
Binita Phartiyal & Kamlesh Kumar [& Vivek Prasad
(Lucknow Univ.)]



Project— Development of high-resolution long-term tree-ring proxy climate records from eastern Himalayan region, India (Sponsored by DST, New Delhi, No. ES/48/ICRP/005/2005)

Project completion report has been finalized and submitted to DST, New Delhi, for evaluation.

R.R. Yadav, B. Sekar & Harinam Joshi

Project— Late Holocene climate records from the Himalayan region: high-altitude tree ring and pollen proxy records (Sponsored by DST, New Delhi, No. SR/S4/ES-181/2005)

Finalized two research papers on the reconstruction of mean summer temperature (AD 940-2008) using ring with chronology of *Juniperus polycarpos* from Lahaul and another on precipitation reconstruction using *Cedrus deodara* (AD 1410-2005) chronology prepared from Kinnaur.

R.R. Yadav

Project— Late Quaternary vegetational and climatic oscillations as deduced from radiocarbon dates and palynodata of older alluvium sediments on the south bank of the Brahmaputra Plains (Tinsukia & Dibrugarh districts) in east Assam, northeast India (Sponsored by DST, New Delhi, No. SR/S4/ES-21/Brahmaputra-I/2005 (P-8) 15.03.2007)

Carried out pollen morphological studies of 30 major tropical arboreal taxa belonging to moist deciduous and semi-evergreen forest of Jokai and Jeypore reserve forest, Dibrugarh. The microphotographs have also been documented from the studied taxa. The pollen morphological features help in precise identification of sub fossil pollen in sediments. Pollen assemblage from Jokai (2100 yrs BP at 120 cm), Jeypore (4200 yrs BP at 120 cm), and Jairampur (6650 yrs BP at 310 cm) sedimentary profiles of upper Assam reflect three fold of climate sequences, viz. semi arid–warm and humid–increasing warm and humid. The establishment of vast low land forest with marshy swamp is evident during 1200 yrs BP in Jeypore, 700 yrs BP in Jokai, and 500 yrs BP in Jairampur reserve forest. The area is threatened at medium to high level anthropogenic impact as evidenced by the occurrence of degraded palynomorphs along with adequate fungal elements largely of grass pathogen, viz. *Diplodia*, *Glomus*, *Alternaria*, *Curvularia*, *Nigrospora*, *Cookeina*, *Xylaria*, Microthyriaceae, etc.; providing clues for pastoral activity and biological degradation of microbiota during sedimentation under mostly warm and moist climate. Assemblage of *Carya arborea*,

Rhododendron ellioti and *Tsuga* pollen from Jeypore reserve forest sediment during 4200 yrs BP is significant, which is not growing presently around the study area. The accumulation of exotic plant pollen in assemblage is suggestive of long distance transportation of pollen from high altitude. Ferns are suggestive of subtropical to cool temperate in origin.

The preliminary palynological study of a 3 m river section from Saraighat, Dibrugarh district indicates influence of wide water conditions as evidenced by presence of Desmids, Diatoms along with typical water plants in recent past. However, sand zones are palynologically barren excepting few grass pollen, Tubuliflorae, Onagraceae and fungal remains. Typical flood plain pollen assemblage may be identified after detail study with radiometric dates (in progress). As the palaeoflood records are of great significance in determining the magnitude and frequency of flood episodes and thus past monsoon conditions, the laminated fine-medium sand /silt sandwiched mud layers of varied thickness should be worked out in detail.

S.K. Bera & Swati Dixit

Project— Magnetostratigraphic, palaeontological and sedimentological studies of some selected sections of Bhuban Formation of Tripura-Mizoram Accretionary Belt (Sponsored by DST, New Delhi, No. ESS/16/254(4)/2005 dated 20.04.2007)

About 20 fossil woods from the Tipam Group of Mizoram have been cut and their study is under progress. Attended a National Seminar on Geodynamics, sedimentation and biotic response in the context of India-Asia collision held at Aizawl during November, 2009.

R.C. Mehrotra & Gaurav Srivastava

Project—Cenozoic vegetation and climate changes in China and India and their response to the Himalayan uplift (Sponsored by DST, New Delhi, No. DST/INT/PRC/Proj-1/2008, dated 11.09.2008)

Studied 16 fossil woods collected from the Pliocene sediments of Yunnan Province, China which is located in the far southwest of the country. Most of them are well preserved and diffuse-porous in nature indicating the tropical climate during the deposition of the beds. They are exposed under the high power microscope and their further study is under progress.

Went for a field work in the Hainan Province which is the smallest province of China. It is located in the South China Sea, separated from Guangdong's Leizhou



Peninsula to the north by a shallow and narrow strait. Collected some fossil woods for the first time from the Eocene deposits of the Changchang Basin of this island. Also collected some leaves, seeds and rhizomes from the same horizon. In addition, visited the Xinglong Tropic Botanic Garden and the Jianfengling Forest Garden where the tropical rain forests have been conserved. Excellent facilities exist in the forest to study the rare plants. Collected more than 175 rare and endemic modern plants from various places in China. Also visited Natural History Museum in Jianfengling where fossils of both plants and animals of various ages can be viewed and studied.

A Chinese delegation comprising three scientists—Prof. Yu-Fei Wang, Prof. Yi-Feng Yao and Dr. Jian Yang visited the Institute. Went to Amarkantak (Anuppur district, Madhya Pradesh) to study the cultivation of the medicinal plants in the herbal garden of the Forest Office. Also surveyed and studied the existing sal forests and jointly collected some plants from there. After this, they went to the National Fossil Park in Ghughua (Dindori district, Madhya Pradesh) for the study of the earliest Tertiary flora of India. The fossil park is very rich in the fossil woods. Also had a visit to the Bandhavgarh Reserve Forest (Umariya district, Madhya Pradesh) in order to have a glimpse of the flora and fauna existing there. We jointly collected some plants from there for the herbarium. Later, went to Kolkata to study the mangrove vegetation of Sunderbans and jointly collected some plants from there. Visited the famous Botanical Garden and consulted the Central National Herbarium, Howrah. In the last, visited the Botany Department of the Kolkata University, viewed its fossil museum and interacted with the students of Palaeobotany and teachers working there.

N.C. Mehrotra, R.C. Mehrotra & D.C. Saini [& Cheng-Sen Li, Yu-Fei Wang & Yi-Feng Yao
(IB, Beijing, China)

Project—Fluctuation in the Zemu area based on multi proxy records, tree-ring, pollen and isotopic data (Sponsored by DST, New Delhi, No. ES/91/38/2005, dated May 2008)

A 381 years long chronology of *Abies densa* extending from AD 1628-2008 has been prepared. Tree-growth climate relationship and relationship with glacial fluctuation is in progress.

A. Bhattacharyya & Mayank Shekhar

Project—Analysis of climatic changes since LGM from south–west continental margin of India using multi-proxy data: pollen, diatom and tree-ring data (Sponsored by ISRO-IGB, 2009)

Modern pollen data base of the Westernghat region has been prepared based on the literature survey and preparing pollen slides from taxa growing at this region. In addition, a 54 cm long profile Kanjani, collected from Kerala has been macerated for pollen analysis. Counting of pollen grains is in progress.

A. Bhattacharyya, S.K. Shah & Sandhya Sharma

Project—Late Pliocene palynochrono-startigraphy in north-eastern part of Cauvery Delta: Implication in palaeoclimatic sea-level studies (Sponsored by DST, New Delhi, No. SR/S4/ES-264/2007, dated 30.09. 2008)

Field work is conducted in Pichavaram and adjoining areas. Five core samples, 58 surface soil samples, and water samples have been collected for the geochemical and palynological study. The geochemical and palynological studies of surface soil samples and water samples have been completed and the manuscript is prepared. Palynological study in the sediment core samples is under progress.

Anjum Farooqui & Jyoti Srivastava

Project—Palynology and sediment-geochemistry of the Chaurabari (Kedarnath) and Hamtah (Lahaul-Spiti) Glacier deposits, Western Himalaya: An investigation of high-altitude climate variability in Holocene ring Holocene (Sponsored by DST, New Delhi, No. ES/91/19/2008)

Available literature pertaining to glaciological and palynological work around the Chaurabari and Hamtah glaciers is updated. Some samples from the previous project on Chaurabari Glacier have been processed and slides are scanned for palynomorphs.

Ratan Kar

Project—Palaeobotanical studies on Indian and Brazilian sedimentary basins with special reference to marine dinoflagellate cysts, Gondwana flora and their applications (Sponsored by DST, New Delhi, No. DST/INT/Brazil/RPO-24/2007, dated 22.01.2009)

Trilete, azonate and gulate dispersed fossil megaspores have been studied from Lower Pennsylvanian (lower portion of Itararé Subgroup) of Campinas (Westphalian) and Monte Mor (Kazimovian) São Paulo,

Paraná Basin, Brazil. Eighteen species, viz. *Bokarosporites rotundus*, *B. psilatus*, *Banksisporites utkalensis*, *B. endosporitiferous*, *B. dijksrae*, *B. tenuis*, *Biharisporites spinosus*, *Duosporites pervursus*, *Duosporites* sp.a, *Duosporites* sp.b, *Lagenicula horrida*, *Lagenicula* sp, *Lagenoisporites rugosus*, *L. brasiliensis*, *L. sinuatus*, *L. nudus*, *Lagenoisporites* cf. *hispanicus*, *Lagenoisporites* sp. have been systematically analysed. Except *Duosporites* sp.b, all the other taxa are recorded from Westphalian of Campinas. The assemblage, to some extent, is comparable with megaspore assemblage from Permian of India.

Examined and photographed megafossils from Early Permian of Cerquillo, Parana Basin. The Flora is comparable with Karharbari flora of India. Also observed plant megafossils from Itarare Subgroup, Tubarao Group (Late Carboniferous) of Monte Mur locality. Besides, palynological studies are carried out on samples of upper part of Itararé Formation (Permo-Carboniferous). Palynological slides of Monte Mor locality were scanned and quantitatively analysed. Monte Mor palynoflora seems to belong *Crucisaccites monoletus* zone as this taxa have been identified in the samples. Photographs of nicely preserved stratigraphically significant taxa are taken. The paper has been finalized and drafted. Samples from Cirquiliho locality of Brazil are also processed. Only one sample yielded very few poorly preserved palynomorphs. More rock sample is required for remaceration.

A field trip has been undertaken to Castello Branco Highway and Cerquillo-Sao Paulo, Parana Basin to see Permian localities and lithologically marked Permo-Triassic boundary.

N.C. Mehrotra, Neerja Jha & Rajni Tewari
[& Mary EC Bernardes de Oliveira, Mitsuru Arai & Rosemarie Rohn (Brazil)]

Project— Palaeobiological studies from the Ganga Basin and their biostratigraphic correlation with the pre-Tertiaries type sections of Garhwal Himalaya (Sponsored by ONGC, No. BLKM/Ganga/09-10/BSIP)

The pre-unconformity sequences lying below the Siwalik Group in the Sahajahanpur Well No. 1, Ujhani Deep Well-1 and Ujhani Structure well-1 have been examined. Visited Dehradun three times (in November, December and March) for collection of samples from the Core House and to discuss with the scientists of Palynology Laboratory (KDMIPE) regarding the palynofossils-microbiota of Ganga Basin and samples collection of Pre-Tertiaries sediments (Baliana-Krol-Tal

groups), of Garhwal, lesser Himalaya. Observations are carefully made on the drill core sequence and lithology and drill cores for macroscopic biota from the wells of Sahajahanpur, Ujhani, Tilhar in Ganga Basin. Collected 163 core samples (75 from Sahajahanpur well, 20 from Ujhani Deep, 68 from Ujhani Structure well) are palynologically analysed. Completed re-studies of 27 palynological slides belonging to Shajahanpur Well (SPN-1) obtained from KDMIPE, specifically those which have been figured by Prasad and Asher (2001). Photomicrography of the significant microbiota has been done after re-examination and also macrobiota preserved on the bedding planes of the shales. All the forms have been carefully re-assessed for their generic identification as published.

Sequentially collected 150 palynological samples and macroscopic biota both algae and animals preserved in heterogeneous lithofacies from the exposed out crops in three sections, viz. i) Dehradun-mule track section: Nagthat Member (9 samples), ii) Dehradun-Maldeota mine section: members of Blaini-Infrakrol-Krol-Lower Tal (49 samples), and iii) Maldeota-Gopichand Ka Mahal section: members of Krol-Tal formations (27 samples). Prepared slides both in petrographic thin sections and palynological preparations of the collected material both from the surface Pre-Tertiaries samples- viz. Blaini-Krol-Tal groups belonging to Garhwal Himalaya and subsurface samples available at KDMIPE. 150 palynological slides of (MD1-MD6) productive samples of Baliana Group exposed in Maldeota section are prepared and also examined 50 slides of the Blaini diamictite; also completed photomicrography of the well preserved microbiota for detailed assessment of their morphology and stratigraphic ranges. The sphaeromorphs- both simple (Leiosphaerids) and ornamented in association of few acanthomorphs; abundance of cyanobacterial algae (colonial and unbranched filaments) as well as simple VSMs is from the sequence belonging to lower most diamictite of Blaini Formation of Baliana-Krol-Tal groups and indicative Cryogenian for the Blain Formation. This study needs more biotic evidences for confirmation. Prepared lithocolumn of the studied sections belonging to Baliana-Krol-Tal groups, exposed in northern and southern limbs of the Song River in Dehradun district. An interim report of the project has been submitted to Frontier Basins of ONGC Limited, Dehradun in March 2010.

N. C. Mehrotra, Rupendra Babu & V.K. Singh
[& P.K. Maithy & G. Kumar]

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- Srivastava AK & Agnihotri D – Upper Permian plant fossil assemblage of Bijori Formation: A case study of *Glossopteris* flora beyond the limit of Raniganj Formation. *J. Geol. Soc. India*.
- Srivastava AK, Saxena A & Agnihotri D – Trace fossils from the Lower Gondwana sediments of Satpura Gondwana Basin, India. *Geophytology*.
- Srivastava C – Palaeoethnobotanical finds from ancient Naimisharanya, District Sitapur, U.P. during Kushana Period (100-300 A.D.). *Curr. Sci.*
- Srivastava G & Mehrotra RC – New legume fruits from the Oligocene sediments of Assam. *J. Geol. Soc. India*.
- Thakur OP, Singh A & Singh BD – Petrographic characterization of Khadsaliya lignites, Bhavnagar district, Gujarat. *J. Geol. Soc. India*.
- Tripathi A, Murthy S & Singh RK – Palynodating of coal bearing strata near Kundapahari, Pachwara Coalfield, Rajmahal Basin, Jharkhand, India. *J. Palaeontol. Soc. India*.
- Trivedi A, Singh DS, Chauhan MS, Arya A, Bhardwaj AV & Awasthi A – Vegetation and climate change around Ropanchhapra Tal in Deoria District, Central Ganga Plain during the last 1350 years. *J. Palaeontol. Soc. India*.
- Verma P & Rao MR – Quaternary vegetation and climate change in central Narmada Valley: Palynological records from hominin bearing sedimentary successions. In: D Singh & NL Chhabra (eds.) *Proc. Quaternary Geological Processes: Natural Hazards & Climate Change*, CAS in Geology, Lucknow University, Mc Millan Publication.
- Yadav RR – Long-term hydroclimatic variability in monsoon shadow zone of western Himalaya, India. *Climate Dynamics*.

Consultancy / Technical Assistance Rendered

The **Radiocarbon Laboratory** also served as a national facility for various organizations across the country for dating 80 samples like sediments, charcoal, shells and other carbonates etc. under consultancy. The following workers/ institutions availed of the consultancy services:

Agharkar Research Institute, Pune (Maharashtra)
 Centre for Earth Science Studies, Trivandrum (Kerala)
 Centre for Heritage Studies, Trippumpuram (Kerala)
 Deccan College, Pune (Maharashtra)
 Dhyanopask College, Darbhani (Maharashtra)
 Dibrugarh University, Dibrugarh (Assam)
 Dy. DG, Marine Wing, Mangalore (Kerala)
 Institute of Archaeology, Columbo (Sri Lanka)
 Jadavpur University, Kolkata (West Bengal)
 Uttar Pradesh State Archaeology Dept., Lucknow
 University of Calcutta, Kolkata (West Bengal)
 Vikram University, Ujjain (Madhya Pradesh)
 Kozhicode
 Vijay Kumar, Agra (Uttar Pradesh)

The **SEM Unit** has developed many more techniques for cement and building material to investigate the intermolecular binding of particles for homogeneous distribution of particles for strength and compactness. The unit has also developed techniques to investigate nano-particles, nano-films, polymers, semi-conducting material, resins and sample from pharmaceuticals. Drug's effect on the microbiological samples has also been introduced. The unit provided consultancy in investigating the ultra structural morphology and micro-analysis of samples received from the following organizations/universities:

Department of Botany, Lucknow University, Lucknow (Botanical samples- 29)
 Department of Physics, Lucknow University, Lucknow (Nanofilm/powder- 78)
 Department of Chemistry, Lucknow University, Lucknow (Crystals structures /powder- 12)
 Department of Zoology, Lucknow University, Lucknow (Zoological samples- 2)

National Botanical Research Institute, Lucknow (Botanical, Microbiological samples- 19)
 Banaras Hindu University, Varanasi ((Pharmaceuticals /cement /building material samples- 19)
 Central Drug Research Institute, Lucknow (Pharmaceutical samples- 3)
 Saraswati Dental College, Lucknow (Dental materials- 18)
 CSM Medical University, Lucknow (Dental materials- 11)
 Babu Banarsi Das National Institute of Technology and Management, Lucknow (Pharmaceutical samples- 9)
 Central Institute for Plastic Engineering and Technology, Lucknow (Polymer samples- 19)
 Rajkumar Goel Institute of Technology, Ghaziabad (Pharmaceutical samples -7)
 Sobhit Institute of Engineering & Technology, Meerut (Pharmaceutical samples -22)
 Sant Gadge Baba Amravati University, Amravati (Botanical samples- 34)
 Department of Physics, CSJM University, Kanpur (Powder material-15)
 Aligarh Muslim University, Aligarh (Pharmaceutical samples- 9)
 UPKG University of Dental Sciences, Lucknow (Dental materials- 6)
 Indian Institute of Toxicology Research, Lucknow (Natural mineral samples- 24)
 National Botanical Survey, Howrah (Botanical samples- 2)
 Shivdan Singh Institute of Technology and Management, Aligarh (Pharmaceutical samples - 4)
 Career Post Graduate College of Dental Sciences, Lucknow (Dental material- 4)
 Central Institute for Plastic Engineering & Technology, Hazipur, Bihar (Polymer samples-7)
 Central Institute of Medicinal and Aromatic Plants, Lucknow (Botanical samples- 12)

Computer Section has provided the training to two students from Rajkiya Mahila Polytechnic, Lucknow for a period of one month (June 15-July 14, 2009).



The **Library** staff provided technical training to two Library Science trainees– Ms Pragya Pandey and Mrs. Suchi Srivastava sent by the Board of Apprenticeship Training (Northern Region), Kanpur.

Samir Sarkar provided palynological training to Research Scholar of Geology Department, Delhi University, Delhi.

S.K.M. Tripathi imparted training for palynological studies to Mr. Runcie P. Mathews, Research Scholar, IIT, Mumbai for a period of four weeks (in October, 2009).

B.D. Singh provided scientific assistance in observation of lignite microconstituents both under normal and fluorescence modes to Mr. Runcie Paul Mathews of IIT, Mumbai.

B.D. Singh and **Alpana Singh** provided consultancy services to BRGM (France) / MECL (Nagpur) for the coal petrographic study (maceral contents and reflectance values).

Madhav Kumar provided consultancy services to BRGM (France)/ MECL (Nagpur) for the palynological study on coal/shale samples.

S.K.Bera provided guidance to Ms. Soumya Thomas of Nallamuthu Gounder Mahalingam College of Arts and Science, Pollachi for three months (in December, 2009-March, 2010) for her M.Sc. Dissertation work entitled 'Studies on pollen and spores, palynological techniques and its application' for submission to the Bharathiar University, Coimbatore.

M.S. Chauhan imparted training (during April 15-30, 2009) to Mr. Yogendra Babu Sharma, a D.Phil. student at Oxford University, Oxford (UK) regarding the pollen morphological studies of tropical plants distributed in the Gujarat and Maharashtra and the maceration techniques used in extracting of pollen/spores from the Quaternary sediments.

Anjum Farooqui guided two students of B.Tech (O.N.G.C sponsored courses, Rajahmundry, Andhra Pradesh) for their dissertation work in palynological study.

Papers presented at Conferences/Symposia/Meetings

- Basumatary SK & Bera SK – Fungal remains from the late Holocene sediment, West Garo Hills, Meghalaya: Evidence of pollen- spore degradation. *Nat. Sem. Geodynamics, Sedimentation & Biotic Response in the context of India-Asia Collision*, Aizawl, November 2009.
- Bera SK, Mandaokar BD & Dixit S – Late Holocene vegetation development and climate fluctuations in and around Northeastern Tripura, India. *Nat. Sem. Geodynamics, Sedimentation & Biotic Response in the context of India-Asia Collision*, Aizawl, November 2009.
- Bhattacharyya A & Shah SK – Spatio-temporal variation of alpine vegetation vis-à-vis climate during Holocene in the Himalayan region. *Nat. Sem. Geodynamics, Sedimentation & Biotic Response in the context of India-Asia Collision*, Aizawl, November 2009.
- Ghosh, A K. & Sarkar S. 2009. Diversification of the Family Sporolithaceae: A Witness and a Survivor to the Cretaceous-Tertiary Mass Extinctions in India. *XXII Indian Colloq. Micropalaeontol. Stratigr.*, Tiruchirapalli, December 2009.
- Ghosh, A K. & Sarkar S. 2009. Diversity, Growth-form analysis, Taphonomy and Palaeoecological implications of Corallinacean Red Algae and Halimedacean Green Algae from the Prang Formation of South Shillong Plateau (Meghalaya, N-E India). *XXII Indian Colloq. Micropalaeontol. Stratigr.*, Tiruchirapalli, December 2009.
- Guleria JS, Sharma ML, Shukla A – A new record of palm wood (*Palmoxylon*) from the Miocene (Kargil Formation) of Ladakh, Jammu & Kashmir, India. *Nat. Sem. Geodynamics, Sedimentation & Biotic Response in the context of India-Asia Collision*, Aizawl, November 2009.
- Jha N & Goel N – Palynological dating and correlation of coal bearing and associated sediments in Mamakannu Area, Godavari Graben, Andhra Pradesh. *XXII Indian Colloq. Micropalaeontol. Stratigr.*, Tiruchirapalli, December 2009.
- Kar R, Ranhotra PS & Mehrotra NC – Initiatives of Birbal Sahni Institute of Palaeobotany in India's Arctic Endeavour (2009-10). *Nat. Conf. Climatic Changes during the Quaternary: Special reference to Polar Regions & Southern Ocean*, Goa, October 2009.
- Kar R & Singh RS – Pattern of rains in India since Cretaceous: Palaeobotanical and geological perspective. *Nat. Sem. Geodynamics, Sedimentation & Biotic Response in the context of India-Asia Collision*, Aizawl, November 2009.
- Mehrotra RC – Biotic response from north-east India in context of India-Asia collision with special reference to Mizoram. *Nat. Sem. Geodynamics, Sedimentation & Biotic Response in the context of India-Asia Collision*, Aizawl, November 2009.
- Murthy S – Palynostratigraphy of the coal horizon in borehole RJS-2, Raniganj Coalfield, Damodar Basin, West Bengal. *XXII Indian Colloq. Micropalaeontol. Stratigr.*, Tiruchirapalli, December 2009.
- Panjwani M, Alok & Prasad M – Fabaceous fossil woods from the Himalayan foot hills (Siwalik) of Tanakpur area, Uttarakhand, India. *Nat. Sem. Envir. Degrad. & Biodiv.: Problems & Prospects*, Kanpur, November 2009.
- Pauline Sabina K, Jha N & Mehrotra NC – Palaeobotanical evidences to trace evolution through the geological time. *XXII Indian Colloq. Micropalaeontol. Stratigr.*, Tiruchirapalli, December 2009.
- Phartiyal B & Sharma A – Landscape evolution and 13,000-3000 year BP climatic record from Schirmacher Oasis, East Antarctica. *Nat. Conf. Climatic Changes during the Quaternary: Special reference to Polar Regions & Southern Ocean*, Goa, October 2009.
- Pokharia AK – Plant macroremains from the Harappan settlement at Kanmer: A preliminary contemplation. *Int. Conf. Gujarat Harappans & Chalcolithic Cultures*, Bhuj, January 2010.
- Prasad M – Reconstruction of Palaeoclimate from Middle Miocene flora of Koilabas area, Nepal. *Nat. Sem. Deltas & other Sedimentary Basins: Their resource Potential & XXVI Conv. Indian Assoc. Sedimentol.*, Visakhapatnam, December 2009.



- Prasad M – Fossil flora of Tanakpur area in the Himalayan foot hills of Uttarakhand, India and its palaeoclimatic implications. *Nat. Sem. Envir. Degrad. & Biodiv.: Problems & Prospects*, Kanpur, November 2009.
- Prasad M & Khare EG – Studies on the cuticle bearing fossil leaves from the Siwalik foreland basin and its implications. *Nat. Sem. Deltas & other Sedimentary Basins: Their resource Potential & XXVI Conv. Indian Assoc. Sedimentol.*, Visakhapatnam, December 2009.
- Prasad M, Panjwani M & Kannauzia AK – Siwalik fossil leaves from the himalayan foot hills of Darjeeling district, West Bengal, India and their significance. *Nat. Sem. Envir. Degrad. & Biodiv.: Problems & Prospects*, Kanpur, November 2009.
- Rai J & Abha – Nannofossil imprints of Albian transgressive event in Indian subcontinent. *XXII Indian Colloq. Micropalaeontol. Stratigr.*, Tiruchirapalli, December 2009.
- Rai J & Singh A – Reinterpretation of age and depositional environment of Pariwar Formation in Jaisalmer Basin: A nannofossil perspective. *GEOYOUTH-09– All India Students Symp. on Geology*, Udaipur, November 2009.
- Rai J, Singh A & Pandey DK – Early to Middle Albian age calcareous nannofossils from Pariwar Formation of Jaisalmer Basin, Rajasthan, western India and its significance. *8th Int. Cretaceous Symp.*, Plymouth (UK), September 2009.
- Rajanikanth A – Relevance of palaeo-phyto-resource (PPR) studies in Earth System Science (ESS). *Nat. Conf. Earth System Processes & Disaster Management*, Goa, September 2009.
- Rajanikanth A – Coastal Gondwana early Cretaceous floras of India and Antarctica- A climatic reflection. *Nat. Conf. Climatic Changes during the Quaternary: Special reference to Polar Regions & Southern Ocean*, Goa, October 2009.
- Ram-Awatar – Reworked Gondwana palynofossils from Ladakh Himalaya, India and their tectonic implications. *Nat. Sem. Geodynamics, Sedimentation & Biotic Response in the context of India-Asia Collision*, Aizawl, November 2009.
- Ram-Awatar – Fungal remains from Mand Coalfield, Chhattisgarh and their paleoenvironmental significance. *XXII Indian Colloq. Micropalaeontol. Stratigr.*, Tiruchirapalli, December 2009.
- Rao MR - Palynological constraints on Palaeoecology and palaeoenvironment of Miocene sediments of Mangalore, Karnataka, India. *XXII Indian Colloq. Micropalaeontol. Stratigr.*, Tiruchirapalli, December 2009.
- Rao MR, Verma P & Patnaik P- Late Pleistocene vegetation and climate fluctuations in central Narmada Valley, Madhya Pradesh (India). *Nat. Conf. Climatic Changes during the Quaternary: Special reference to Polar Regions & Southern Ocean*, Goa, October 2009.
- Sarate OS – The coal constitution and its impact on the depositional set up around Mailaram area, Godavari Valley Coalfield, Andhra Pradesh, India. *XXII Indian Colloq. Micropalaeontol. Stratigr.*, Tiruchirapalli, December 2009.
- Sarkar S – Sedimentary organic matter of the Subathu Formation (Early Ypresian-Middle Lutetian) of Morni Hills, Lesser Himalayas and its palaeoenvironmental implications. *Nat. Sem. Deltas & other Sedimentary Basins: Their resource Potential & XXVI Conv. Indian Assoc. Sedimentol.*, Visakhapatnam, December 2009.
- Shah SK & Bhattacharyya A – Tree-ring: A proxy record for climate study: An assessment in Indian context. *Nat. Res. Conf. Climate Change*, New Delhi, March 2010.
- Sharma A & Phartiyal B – Landscape, texture, mineralogy and geochemistry of lake sediments of the Schirmacher Oasis, east Antarctica: implication to earth surface processes and climate. *Nat. Conf. Climatic Changes during the Quaternary: Special reference to Polar Regions & Southern Ocean*, Goa, October 2009.
- Singh A & Singh BD – Petrographic composition of Permian Gondwana coals from Rajmahal Basin (Jharkhand), India. *Int. Symp. Adv. Org. Petrol. & Org. Geochem. (joint 61st ICCP-26th TSOP Meeting)*, Gramado (Brazil), September 2009.
- Singh BD & Singh A – Petrology of Indian Permian Gondwana coals: Present status and future needs. *3rd Symp. Gond. Coals*, Porto Alegre (Brazil), September 2009.
- Singh RS & Kar R – Palynology of the Late Cretaceous of India: Implications for the continental collision

- between India and Asia. *Nat. Sem. Geodynamics, Sedimentation & Biotic Response in the context of India-Asia Collision*, Aizawl, November 2009.
- Singh SK & Prasad M – Palaeovegetation and climate during Late Tertiary period in Mahuadanr Valley, Jharkhand, India. *Nat. Sem. Deltas & other Sedimentary Basins: Their resource Potential & XXVI Conv. Indian Assoc. Sedimentol.*, Visakhapatnam, December 2009.
- Singh SK & Prasad M – Addition to Upper Tertiary flora of Mahuadanr Valley, Latehar district, Jharkhand, India. *Nat. Sem. Envir. Degrad. & Biodiv.: Problems & Prospects*, Kanpur, November 2009.
- Singh V, Farooqui A, Mehrotra NC, Ravindra R, Singh DS, Ranhotra PS, Tewari R, Jha N & Kar R – Late Quaternary climate of Ny-Alesund, Svalbard: A study based on biological proxies. *Nat. Conf. Climatic Changes during the Quaternary: Special reference to Polar Regions & Southern Ocean*, Goa, October 2009.
- Singh VK – Studies on the palaeobiological evidences from the Lower Vindhyan deposits of Chitrakut Region, Banda District, Uttar Pradesh. *XXII Indian Colloq. Micropalaeontol. Stratigr.*, Tiruchirapalli, December 2009.
- Srivastava AK – Palaeobotanical records from Gondwana equivalent sediments of north-east India: Correlation, relationship, stratigraphy and palaeogeographical significance. *Nat. Sem. Geodynamics, Sedimentation & Biotic Response in the context of India-Asia Collision*, Aizawl, November 2009.
- Srivastava AK – Plant diversity in Lower Gondwana formations of India. *Golden Jubilee Symp. Contemporary trends in Plant & Microbial Sciences*, Burdwan, March 2010.
- Srivastava G – CLAMP: A developing proxy for quantitative estimation of palaeoclimate. *Nat. Sem. Geodynamics, Sedimentation & Biotic Response in the context of India-Asia Collision*, Aizawl, November 2009.
- Srivastava R – Indian Upper Cretaceous-Tertiary flora before collision of Indian Plate. *Nat. Sem. Geodynamics, Sedimentation & Biotic Response in the context of India-Asia Collision*, Aizawl, November 2009.
- Tewari R, Chatterjee S & Mehrotra NC – Gondwana flora from Allan Hills, Transantarctic Mountains, Antarctica and its palaeoclimatic implications. *Nat. Conf. Climatic Changes during the Quaternary: Special reference to Polar Regions & Southern Ocean*, Goa, October 2009.
- Tewari R & Mehrotra NC – Dispersed fossil plant cuticles from North-East India: Implications in palaeoclimatic interpretation. *Nat. Sem. Geodynamics, Sedimentation & Biotic Response in the context of India-Asia Collision*, Aizawl, November 2009.
- Tripathi SKM, Dutta S, Srivastava D & Mallik M. 2009. Palynology and bulk organic chemistry of Early Palaeogene lignite bearing sequence of Vastan, Cambay Basin, western India. *XXII Indian Colloq. Micropalaeontol. Stratigr.*, Tiruchirapalli, December 2009.
- Yadav RR – Tree rings and climate change studies in eastern Himalayan region: prospects and problems. *Int. Workshop Land Management in Marginal Mountain areas: Vulnerability & adaptation to Global changes*, Shillong, November 2009.



Deputation/Training/Study/Visit in India/Abroad

Scientific Personnel

Binita Phartiyal

Visited Tuebingen University, Germany under the DAAD re-invitation Fellowship for two months during May-July, 2009, where mineral magnetic studies on samples from Ladakh and Antarctica were conducted.

Mukund Sharma, C.M. Nautiyal & G.K. Trivedi

Attended training session on *Web of Science* held at CDRI, Lucknow on June 17, 2009.

Neerja Jha & K.G. Mishra

Participated in a Field Seminar on *Post Barakar Stratigraphy in Peninsular India* organized by Prof. P. Dutta, Indiana State University (USA), Mr. Amit Dutt, Ex. Dy. D.G, GSI and Dr. B.V. Ramanamurthy, Ex. Chief Geologist, SCCL and conducted at Nagpur and other areas from June 21-30, 2009.

A.K. Srivastava

Attended residential programme on *Domestic action and Discipline and How to manage Employment separation lawfully* organized by Institute of Public Administration (Bangalore) and held at Metagalli, Mysore from June 22-24, 2009.

Vartika Singh

Visited National Centre for Antarctic and Ocean Research, Goa from July 07-11, 2009 for collection of Antarctic samples.

Shilpa Singh

Visited Mangalore University, Mangalore from August 09-24, 2009 for training in Rock Magnetic analysis under the guidance of Dr. R. Shankar, Professor of Marine Geology.

Rajni Tewari

Visited Museum, Texas Tech University, Lubbock, US in August 2009 to examine and investigate Permian and Triassic megafossils from Allan Hills, Transantarctic Mountains, South Victoria Land, Antarctica.

Neerja Jha & Rajni Tewari

Visited Institute of Geosciences, São Paulo University, and Department of Palaeontology, University of Guarulhos, S.P. Brazil from September 01-12, and

September 20-21, 2009 under DST and CNPq sponsored Indo-Brazil S&T joint research programme on Palaeobotanical studies on Indian and Brazilian sedimentary basins.

N.C. Mehrotra

Visited Institute of Geosciences, São Paulo University, and Department of Palaeontology, University of Guarulhos, S.P. Brazil from September 11-12 and September 20-21, 2009 under DST and CNPq sponsored Indo-Brazil S&T joint research programme on Palaeobotanical studies on Indian and Brazilian sedimentary basins.

R.S. Singh & Madhav Kumar

Attended the 5th Proficiency Courses on *Modern Practices in Petroleum Exploration* organised at KDMIPE, ONGC, Dehradun from September 14-19, 2009.

Vijaya

Participated in the meeting on Marine and Non-Marine Jurassic held at GSI, Northern Region, Lucknow on September 15, 2009.

Alpana Singh

Attended the pre- ICCP-TSOP Meet short course programme on 'Palynofacies and Organic Facies: Principles, Methods and Applications' conducted by Dr. Graciano M. Filho and his team of Laboratory of Palynofacies and Facies Organic, Federal University of Rio de Janeiro, RJ (Brazil) at Gramado on September 20, 2009. The course covered the integrated study of all aspects of the kerogen assemblage: identification of the individual particulate components, assessment of their absolute and relative proportions and preservation; useful to point out the depositional environmental conditions and hydrocarbon source rock potential.

Participated in the 1st post-ICCP/TSOP Meet field trip to Leao-Butia Coalfield, Rio Grande do Sul, Brazil on September 26, 2009 to observe Permian coal seams of Parana Basin in Recreio/B3 open pit mine. These coals housed in Rio Bonito Formation are of sub-bituminous in rank, and currently used predominantly for power generation.

Alpana Singh & B.D. Singh

Participated in the post-Symposium geological field



trip to Rio Grande do Sul coalfields on September 18, 2009, and visited Charqueadas-Santalita Coalfield of Parana Basin, Brazil. Acquainted with working of the pilot project on enhanced coal bed methane through carbon dioxide injection, besides observed and discussed the lithological/ sediments variations in the full bore-core from the field.

After attending the Symposium on Gondwana Coals and ICCP/TSOP Meet, visited Institute of Geosciences, and Institute of Geochemistry at Federal University of Rio Grande do Sul (UFRGS), Porto Alegre from September 27-29, 2009. Had discussions with Prof. Wolfgang Kalkreuth, an eminent Organic Petrologist and Prof. Maria Peralba, Organic Geochemist, and acquainted with modern techniques used in their well-equipped laboratories.

B.D. Singh

Participated in the 2nd post-ICCP/TSOP Meet field trip to Vale dos Vinhedos, RS on September 26, 2009 to examine the relationship between soil type and climate to champagne and wine quality in different regions of Brazil.

Participated in the Residential Training Programme on 'The Right to Information Act-2005' conducted by Institute of Public Administration, Bangalore and held at Hotel Parkview, Chandigarh from November 16-17, 2009.

A. Rajanikanth

Attended National Childrens Science Congress (NCSC) Workshop held at PMS, Lucknow on September 25, 2009.

S.K. Bera

Attended 4th Meeting of the DST-PAMC-SSS (Brahmaputra Corridor) held at NGRI, Hyderabad during October 12-14, 2009.

Attended Intra-Corridor Meeting on SSS Programme (DST Sponsored) held at Geology Department, Dibrugarh University, Dibrugarh on March 30, 2010.

A.K. Ghosh

Attended the second meeting of the CGPB Subcommittee X – Fundamental and Multidisciplinary Geosciences held at GSI, Central Headquarters, Kolkata on November 27, 2009.

Participated in the Scientists and Administrators Interface Training Programme held at Centre for Disaster Management of Lal Bahadur Shastri National Academy

of Administration, Mussourie from December 21-25, 2009.

N.C. Mehrotra & B.D. Singh

Attended the second meeting of CGPB Committee XI – Geoinformatics and Data Management held at GSI, Northern Region, Lucknow on December 15, 2009.

C.M. Nautiyal

Attended programme related to Preventive Vigilance organized at CBI Academy, Ghaziabad from November 29 to December 03, 2009.

R.R. Yadav

Attended Group Monitoring Workshop at the Institute of Geomagnetism during December 10-11, 2009 to present the progress report of the work done under the DST sponsored project 'Development of high-resolution long-term tree-ring proxy climate records from eastern Himalayan region, India.

Rashmi Srivastava

Attended the training programme on 'Innovation Management for Scientists and Technologists' organized at Administrative Staff College of India, Hyderabad from December, 13-19, December 2009.

Srikanta Murthy

Attended International Field Workshop on Vindhyan Basin, Son Valley Area, Central India organised by The Palaeontological Society of India, Lucknow from January 20-31, 2010.

S.K. Shah

Attended programme on Coping with the disaster of Climate Change held at Disaster Management Cell, U.P. Academy of Administration and Management, Lucknow from February 15-19, 2010.

Mayank Shekhar

Attended Workshop on *Snow Characterization* organized by DRDO, SASE at Manali from April 13-15, 2009.

Ratan Kar

Visited NCAOR, Goa on March 18, 2010 for presentation of the project 'Multi proxy geological studies in Svalbard area and surrounding Ocean: Implications to Quaternary palaeoclimate, Permo-Carboniferous and Mesozoic-Tertiary biostratigraphy, biogeography, ecology, tectonics and hydrocarbon potential, related to the 4th Indian Arctic Expedition.



Technical Personnel

Kavita Kumar

Attended the meeting of Librarians at ARIES, Nainital as a Nodal Officer.

Administrative Personnel

S.C. Bajpai

Attended the Seminar Evolve: Towards e-governance held at Taj Residency, Lucknow on July 24, 2009.

Attended the Society for Energy Engineers and Managers, Uttar Pradesh Workshop series on 'Energy Efficiency, Codes and Rating in Buildings' held at Lucknow from September 10-11, 2009.

Attended the Bureau of Energy Efficiency, Technical Workshop on 'Adopting of Energy Efficient Process Technology and Practices and Implementation of ECBC in Buildings/Hotels/Offices' held at Lucknow on September 16, 2009.

Attended the National Conference on Renewable Energy-2009 held at Vyas Institute of Engineering and Technology, Jodhpur from November 05-07, 2009.

Attended the All India Seminar on Indian Power Sector: Opportunities and Challenges Ahead, The

Institution of Engineers (India) held at Lucknow from December 18-19, 2009.

Attended 2nd National Conference on Nonomaterials and Nanotechnology held at University of Lucknow, Lucknow from December 21-23, 2009.

Attended the Solar Energy Conclave held at New Delhi on January 11, 2010.

Attended the All India Seminar on Energy Management and Energy Audit, The Institution of Engineers (India) held at Lucknow from January 16-17, 2010.

Attended the Symposium and Exhibition on E-Learning/E-Class Room Solutions held at Taj Residency, Lucknow on February 05, 2010.

Attended the Symposium on Climate Change: Issues and Imperatives held at Babasaheb Bhimrao Ambedkar University, Lucknow on February 16, 2010.

Attended the National Conference on Advances on Materials and Devices for Renewable Sources held at Jaipur Engineering College, Kukas, Jaipur from February 25-27, 2010.

Attended the Workshop on Energy Efficient Green/Solar Buildings organized by the UPNREDA and MNRE and held at Taj Residency, Lucknow on March 05, 2010.

Deputation to Scientific Meets

A. Bhattacharyya & S.K. Shah

National Workshop on Climate Change and Himalayan Environment held at Department of Forestry, HNB Garhwal University, Srinagar during April 06-07, 2009.

M.R. Rao, A. Bhattacharyya, S.K. Shah, Poonam Verma, Mayank Shekhar & Sandhya Sharma

Concepts in Quaternary Climate studies with emphasis on Dendrochronology and Palynology held at BSIP, Lucknow during May 12-18, 2009.

A. Bhattacharyya

Workshop on Evaluation of Research Projects for Planning the Indian Scientific Expedition to Antarctica held at NCAOR, Goa during June 11-12, 2009.

N.C. Mehrotra, Neerja Jha & Rajni Tewari

XXI Brazilian Palaeontology Congress held at Computer Hall, Belem, Para State, Brazil during September 13-19, 2009.

A. Rajanikanth & Ratan Kar

National Conference on Earth System Processes and Disaster Management held at International Centre, Goa during September 15-17, 2009.

Alpana Singh & B.D. Singh

3rd Symposium on Gondwana Coals held at Porto Alegre, Brazil during September 16-18, 2009.

International Symposium on Advances in Organic Petrology and Organic Geochemistry— Joint Meeting ICCP-TSOP (61st International Committee for Coal and Organic Petrology – 26th The Society for Organic Petrology) held at Gramado, Porto Alegre, Brazil during September 19-26, 2009.

N.C. Mehrotra, A.K. Srivastava, M.R. Rao, A. Rajanikanth, Rajni Tewari, Anupam Sharma, Binita Phartiyal, Ratan Kar, P.S. Ranhotra & Vartika Singh

Climatic Changes during the Quaternary: Special reference to Polar Regions and Southern Ocean jointly organized by BSIP and NCAOR and held at NCAOR, Goa during October 22-23, 2009.

R.R. Yadav

International Workshop on Land Management in Marginal Mountain areas: Vulnerability and Adaptation to Global Changes held at Northeastern Hill University, Shillong during November 09-11, 2009.

All the Scientific staff

Conclave on Evolution— Life's Continuum held at BSIP, Lucknow on November 15, 2009.

N.C. Mehrotra, A.K. Srivastava, J.S. Guleria, R.S. Singh, Ram Awatar, R.C. Mehrotra, Rajni Tewari, Rashmi Srivastava, Ratan Kar & Gaurav Srivastava

National Seminar on Geodynamics, Sedimentation and Biotic Response in the context of India-Asia Collision held at Department of Geology, Mizoram University, Aizawl during November 26-28, 2009.

Mahesh Prasad

National Seminar on Environmental Degradation and Biodiversity: Problems and Prospects held at D.A.V. College, Kanpur during November 29-30, 2009.

M.R. Rao, Anjum Farooqui & Biswajeet Thakur

Pre-XXII Indian Colloquium Workshop on Applications of Micropalaeontology in Environmental and Energy Resource Management held at National College, Tiruchirapalli during December 14-15, 2009.

M.R. Rao, S.K.M. Tripathi, Ram Awatar, O.S. Sarate, Jyotsana Rai, Anjum Farooqui, A.K. Ghosh, Srikanta Murthy, V.K. Singh, Biswajeet Thakur, Pauline K. Sabina, Neha Goel & Suman Sarkar

XXII Indian Colloquium on Micropalaeontology and Stratigraphy held at PG and Research Department of Geology, National College, Tiruchirapalli during December 16-18, 2009.

Samir Sarkar, Mahesh Prasad, E.G. Khare & S.K. Singh

National Seminar on Deltas and other Sedimentary Basins: Their Resource Potential & XXVI Convention of Indian Association of Sedimentologists held at Andhra University, Visakhapatnam during December 16-18, 2009.

A.K. Pokharia

International Conference on Gujarat Harappans and Chalcolithic Cultures held at Bhuj, Gujarat during January 26-31, 2010.

Sandhya Sharma

International Workshop on Monitoring of River Health using Diatoms held at Department of Geology, Periyar University, Salem (TN) during February 17-19, 2010.

S.K. Shah

National Research Conference on Climate Change held at Indian Institute of Technology, New Delhi during March 05-06, 2010.

A.K. Srivastava

Golden Jubilee Symposium on Contemporary trends in Plant and Microbial Sciences held at Department of Botany, Burdwan University, Burdwan during March 19-20, 2010.



A view of Annual General Meeting of the Geological Society of India, Bangalore organized during the *National Seminar on Geodynamics, Sedimentation and Biotic Response in the context of India-Asia Collision* held at Department of Geology, Mizoram University, Aizawl during November 26-28, 2009 participated by the Director, BSIP.

Lectures Delivered

Scientific Personnel

N.C. Mehrotra

High Impact Palynological studies in Hydrocarbon Exploration in Indian Perspective (Invited Talk) at XXI Brazilian Palaeontology Congress, Belem, Brazil (September 2009).

High Impact Micropalaeobotany in Hydrocarbon Exploration in Indian Petroliferous basins (Foundation Day Lecture) at NGRI, Hyderabad (October 12, 2009).

Neerja Jha

Permian Palynostratigraphy in India at Sao Paulo University, São Paulo, Brazil (September 03, 2009).

Late Palaeozoic (Permian) palynoflora of India, dating and correlation of coal-bearing horizons in India at Computer Hall, Belem for students during the XXI Brazilian Palaeontology Congress (September 16, 2009).

S.K.M. Tripathi

Prithvi ka Prachin Itihas (Hindi) at Raj Bhasha Vaigyanic Sangosthi, ITRC, Lucknow (December, 2009).

Chanchala Srivastava

Application of Modern Techniques in the study of Past at the Teachers' Training Course at Department of Ancient History, Culture and Archaeology, University of Allahabad, Allahabad (April 04-05, 2009).

Rakesh Saxena

Know thy Coal at Mining Officers Programme at IICM, Ranchi (March 2010).

A. Rajanikanth

Earth and Phyto-diversity at SKD Academy, Lucknow (September 12, 2009).

Mukund Sharma

Precambrian Biosphere and Astrobiology at the Geological Society of India, Bangalore (November 25, 2009)

Evidence of Precambrian Biosphere-Post Darwin Era at National Botanical Research Institute, Lucknow under the aegis of UPASTA, Lucknow (February 12, 2010).

Rajni Tewari

Late Palaeozoic Floral Successions of India at the Department of Geosciences, University of Sao Paulo, Sao Paulo, Brazil (September 2009).

Late Palaeozoic Gondwana Flora of India in XXI Brazilian Palaeontology Congress, Belem, Para, Brazil (September 2009).

C.M. Nautiyal

Radio ke lie kayse Likhen? and Doordarshan ke lie Lekhan (2 lectures) during the Distt. Science Club Workshop on Science Writing at GSI, Lucknow (May 23-24, 2009).

Earth- Our Planet- Our Home in the meeting of the Society of Earth Scientists at BSIP (June 8, 2009).

Lecture on NCSC projects at the Workshop on NCSC at Aryabhat Institute of Engineering, Baghpat (July 12, 2009) and at PMS Janakipuram (September 25, 2009).

The Solar Eclipse- 2009 (lecture & interaction) at Regional Science City, Lucknow (July 22, 2009).

Global Warming, Climate Change & Carbon Footprints during the function for SN Tripathi Memorial Lecture by Svayamsiddha at NBRI, Lucknow (Aug 23, 2009).

Science and Technology in India (2 sessions) during the Refresher Course at Academic Staff College, University of Lucknow (August 29, 2009).

Brahmand mein Jeevan (Chief Guest's Speech) at CIMAP, Lucknow (September 22, 2009).

Hindi Hamari Rashtrabhasha (Chief Guest's speech) on Hindi Divas Udghatan (September 25, 2009) and Vishvabhasha Hindi (October 8, 2009) at Lalit Kala Akedemi, Lucknow.

Radiocarbon Dating: the Approach during the National Training Workshop at BSIP (May, 2009).

Global Warming and Environment at Refresher Course (November 11, 2009) and *Global Warming and Environment: Project Approach*, Academic Staff College, Lucknow (November 21, 2009).

Writing for Radio, Script-writing for TV and Science-Communication Scenario in India (3 lectures) in

the Workshop on Science Writing Journalism at Chennai (December, 2009).

Principles and Applications of Radiocarbon Dating at HNB Garhwal University during INSPIRE Camp (January 15, 2010).

Careers in Science at Regional Science City, Lucknow (February 01, 2010).

Isotopic Approach in understanding Climate Change at Uttar Pradesh Administrative Training Institute, Lucknow (February 16, 2010).

Jalavayu tatha Paryavaran Pradushan during the Workshop at Rashtriya Hathkargha Nigam, Lucknow (February 17, 2010).

Carbon Isotopes in understanding Palaeoclimate and Palaeovegetation at National Academy of Sciences, Allahabad (February 19, 2010).

Climate, Environment and Pollution (2 sessions) at Academic Staff College, University of Lucknow (March 27, 2010).

Anjum Farooqui

Potentials of the Camoebians as proxy for monitoring Palaeoecology and Palaeoclimate at Pre-ICMS Workshop, Tiruchirapalli (December 2009).

A.K. Ghosh

Management of Natural Disaster: Evidences from Andaman & Nicobar Island in Scientists and Administrators Interface Training Programme held at Lal Bahadur Shastri National Academy of Administration, Mussourie (December 22, 2009).

Vartika Singh

Incredible Antarctica at Pioneer Montessori Degree College, Lucknow (August 19, 2009)

By outside scientists in the Institute

Dr. Suryendu Dutta, Dept. of Earth Sciences, Indian Institute of Technology, Mumbai

Biogeochemistry of Palynomorphs as revealed by Pyrolysis-Gas Chromatography Mass Spectrometry (April 01, 2009)

Dr. Akhilesh Gupta, Advisor, DST, New Delhi

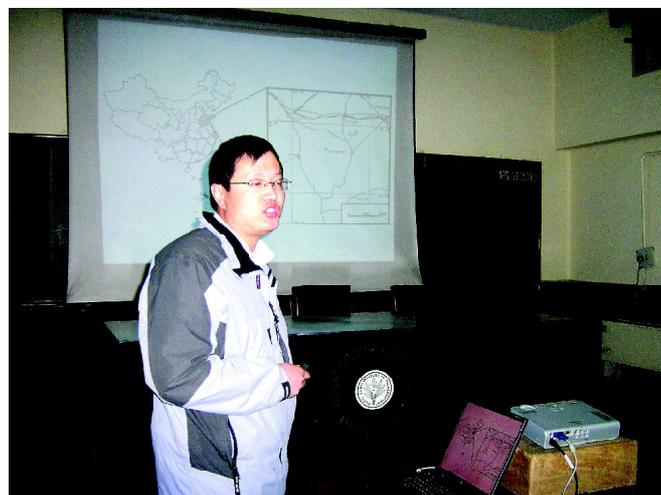
Climatological Aspects: Researches and Projects (December 11, 2009)

Dr. Yu-Fei Wang, Institute of Botany, Beijing, China

The Phytogeography of the extinct Angiosperm Nordenskiöldia (Trochodendraceae) and its response to the Climate Changes (January 13, 2010)

Dr. Jian Yang, Institute of Botany, Beijing, China

The reconstruction of Palaeoclimate in Shanwang Miocene Basin (January 13, 2010)



Dr. (Mrs.) Lalitha Vaidyanathan, Press Trust of India, Mumbai

Communicating Science to Common People (January 25, 2010)

Administrative Personnel

S.C. Bajpai

- *HVAC Systems and Utilities in context of ECBC* (Invited paper) at the Society for Energy Engineers & Managers, Uttar Pradesh Workshop Series, Lucknow (September 10-11, 2009).
- *Application of HVAC in Buildings/Hotels/Offices-Bioclimatic Approaches and Passive Solar Techniques* (Invited paper) at the Bureau of Energy Efficiency Technical Workshop, Lucknow (September 16, 2009).
- on Sub-Theme - *Energy* of the Main Theme: Planet Earth our Home: Explore, Care and Share, at Workshop for teachers, PMS, Jankipuram, Lucknow (September 25, 2009).
- on *Green Buildings* (two lectures) in the Refresher Course in Environmental Studies, Academic Staff College, University of Lucknow, Lucknow (November 28, 2009).
- *Energy Conversion opportunities in Buildings* (Invited paper) at All India Seminar on Indian Power Sector: Opportunities and Challenges Ahead, Lucknow (December 18-19, 2009).
- *Energy Audit: A need for Today* (Invited paper) at All India Seminar on Energy Management and Energy Audit, Lucknow (January 16-17, 2010).
- *Green Buildings: A positive impact on the Environment* (Invited paper) at the Workshop on Energy Efficient Green/Solar Buildings, Lucknow (March 05, 2010).



A view of training programme for IVth Class Employees held during 16.03.2009 to 29.03.2010

Recognition

N.C. Mehrotra

Awarded 'L. Rama Rao Centenary Award' by the Geological Society of India, Bangalore for life time contribution to Indian Biostratigraphy and Palaeontology, on the occasion of society's annual meeting at Aizawl (in November 2009).



N.C. Mehrotra, A.K. Srivastava & R.K. Saxena

Awarded 'Palaeobotanical Society Golden Jubilee Medal' by the Palaeobotanical Society of India, Lucknow for life time contribution for development of Palaeobotany (on October 23, 2009).

A.K. Srivastava

Sessional Chairman, National Conference on Climatic Changes during the Quaternary: Special reference to Polar Regions and Southern Ocean held at NCAOR, Goa (in October, 2009).

Rapporteur of one of the Sessions of National Seminar on Geodynamics and Biotic Response in the context of India-Asia collision held at Mizoram University, Aizawl (in November, 2009).

Awarded the 'Visiting Fellowship' at the Botany Department, Burdwan University, Burdwan (March 14-23, 2010).

Sessional Chairman, Golden Jubilee Symposium on Contemporary trends in Plant and Microbial Sciences held at Burdwan University, Burdwan (in March, 2010).

M.R. Rao

Chaired Technical Session VIII of the XXII Indian Colloquium on Micropaleontology and Stratigraphy held at Tiruchirapalli (in December, 2009).

S.K.M. Tripathi

Chaired Technical Session VII of the XXII Indian Colloquium on Micropaleontology and Stratigraphy held at Tiruchirapalli (in December, 2009).

Ram Awatar

Co-chaired a Session in XXII Indian Colloquium on Micropalaeontology and Stratigraphy held at Tiruchirapalli (in December, 2009).

A. Rajanikanth

Co-Chairman, Conclave on Evolution-Life's Continuum, BSIP, Lucknow (in November, 2009).

Session Rapporteur at National Conference on Climatic changes during the Quaternary: special reference to Polar regions and southern ocean, Goa (in October, 2009)

Mukund Sharma

Awarded the 'Iyengar-Sahni Medal-2009' for the best paper published in the *Palaeobotanist* in preceding two years by the Birbal Sahni Institute of Palaeobotany, Lucknow.

Awarded 'Sharda Chandra Gold Medal-2009' in Palaeontology by the Palaeontological Society of India, Lucknow.

A. Bhattacharyya

Felicitated as a participation member in the 26th Indian Scientific Expedition team in Antarctica by NCAOR, Goa on September 15, 2009.

Alpana Singh & B.D. Singh

Elected Fellows of the Palaeobotanical Society of India, Lucknow.

Jyotsana Rai

Chaired Technical Session III in XXII Indian Colloquium on Micropalaeontology and Stratigraphy held at Tiruchirapalli (in December, 2009).

Asha Gupta

Conferred, Fellow of the International Scientists Unique Researchers' Yare Association.

C.M. Nautiyal

Chief Guest, Valedictory Function of the Hindi Pakhwara at CIMAP, Lucknow on September 22, 2009.

Chief Guest, Inaugural and Valedictory Functions of the Hindi Pakhwara at Lalit Kala Akedemi, Regional Centre, Lucknow on September 25, 2009.

Chaired a session during the function for SN Tripathi Memorial Lecture by Svayamsiddha on 'Global Warming, Climate Change and Carbon Footprints' at NBRI, Lucknow on August 23, 2009.

A.K. Ghosh

Co-Chaired a Technical Session in XXII Indian Colloquium on Micropalaeontology and Stratigraphy held at Tiruchirapalli (in December, 2009).

Binita Phartiyal

Awarded DAAD re-invitation Fellowship for 2 months to work at Tuebingen University, Germany.

Deepa Agnihotri & Shilpa Singh

Awarded 'P.C. Bhandari Medal-2009' of BSIP for best pieces of research work carried out as Research Scholars.



A view of deliberations of Conclave on Evolution - Life's Continuum held on 15th November, 2009



Representation in Committees/Boards

Scientific Personnel

N.C. Mehrotra

President, The Palaeobotanical Society of India, Lucknow.

Chief Editor, *The Palaeobotanist*.

Member, Indo-French Technical Association, New Delhi.

Member & Indian Correspondent for Newsletter, American Association of Stratigraphic Palynologists.

Member, Governing Body, Wadia Institute of Himalayan Geology, Dehradun.

Member, Governing Council, National Centre for Antarctic & Ocean Research, Goa.

Member, Council of the Geological Society of India, Bangalore.

Chairman, Local Advisory Council, Regional Science Centre, Lucknow (Ministry of Culture).

Chairman, Organizing Committee, Conference on *Climatic Changes during the Quaternary: Special reference to Polar Regions and Southern Ocean*, Goa (October 2009).

Chairman, Organizing Committee, *Conclave on Evolution: Life's Continuum*, BSIP (November 2009).

A.K. Srivastava

Editor, *The Palaeobotanist*.

Secretary, The Palaeobotanical Society of India, Lucknow (since January 2010).

Member, Editorial Board, *Geophytology*.

Councillor, International Federation of Palynological Societies.

Member, Steering Committee, Project- Conservation Education for Critically Important National Parks and Wildlife Sanctuaries through a Comprehensive Education Programme (Bharati Vidyapeeth Institute of Environment Education and Research, a Deemed University, Pune).

Member, Coordination Committee for the establishment of Birbal Sahni Memorial Fossil Park and Museum, Dept. S&T, Govt. of Jharkhand, Ranchi.

Member, Organizing Committee, Conference on *Climatic Changes during the Quaternary: Special*

reference to Polar Regions and Southern Ocean, BSIP & NCAOR, Goa (October 2009).

Usha Bajpai

Member, Executive Committee, Electron Microscope Society of India.

Member, Technical Advisory Committee of U.P. Environmental Concern.

Rahul Garg

Vice President, The Palaeobotanical Society, Lucknow (till December 2009).

Joint Secretary, The Palaeontological Society of India.

J.S. Guleria

Chief Editor, The Palaeobotanical Society & *Geophytology* (till December 2009).

Member, Executive Committee, Lucknow University's Botany Department Alumni Association.

Neerja Jha

Member, Organising Committee, National Conference on *Earth System process and Disaster Management*, Goa.

R.K. Saxena

Chief Editor, The Palaeobotanical Society of India, Lucknow (since January 2010).

Treasurer, The Palaeobotanical Society, Lucknow (till December 2009).

Member, Editorial Board, *Geophytology* (till December 2009).

Rupendra Babu

Liasion Officer SCs/STs employees, BSIP.

Corresponding Member, International Working Group-IGCP Project-493: The rise and fall of Vendian Biota.

S.K. Bera

Councilor, Executive Council, The Palaeobotanical Society, Lucknow.

A. Bhattachayya

Principal Investigator, Workshop on Concepts in Quaternary climate studies with emphasis on Dendrochronology and Palynology, BSIP (in May, 2009).

Member, Advisory Board of the established Uttrakhand



Center on climate Change, Kumaun University
Nainital.

Examiner, Practical Examination, M.Sc. Special paper on
Palaeobotany, Calcutta University.

Asha Gupta

Associate Editor, *Vegetos*.

Member, Executive Body, International Council for
Biodeterioration of Cultural Property.

Madhav Kumar

Member, Executive Council, The Palaeobotanical Society,
Lucknow.

Member, Organising Committee, *Conclave on Evolution:
Life's Continuum*, BSIP

R.C. Mehrotra

Councilor, Executive Council, The Palaeobotanical Society,
Lucknow.

Convener, Smart Administration Cell, BSIP.

Mahesh Prasad

Vice President, BSIP Employee Co-operative Credit and
Thrift Society, Lucknow.

Jyotsana Rai

Member of Jury, 17th Children Science Congress (District
level) at Lucknow (October 24, 2009).

Member, National Working Group, IGCP-506 "Marine
and Nonmarine Jurassic Global correlation and major
geological events".

A. Rajanikanth

Joint Editor, BSIP Annual Report.

Ram Awatar

Treasurer, The Palaeobotanical Society, Lucknow (since
January 2010).

M.R. Rao

Co-Organizing Secretary, Workshop on *Concepts in
Quaternary climate studies with emphasis on
Dendrochronology and Palynology*, BSIP,
Lucknow (May 2009).

D.C. Saini

State Nodal officer for Uttar Pradesh (Nominated),
Society of Ethnobotanists, NBRI, Lucknow.

Joint Secretary, The Palaeobotanical Society, Lucknow.

Member, Sub-Committee, Ethnobotany of State
Biodiversity Board, Uttar Pradesh.

Rakesh Saxena

Faculty, Indian Institute of Coal Science Management,
Ranchi.

Expert for assessment of work of RA, CAS in Geology,
Lucknow University, Lucknow.

Expert for assessment of work of SRF, CAS in Geology,
Lucknow University, Lucknow.

External Examiner, M.Sc. Geology (Part II) Examination,
Ranchi University, Ranchi.

Mukund Sharma

Member, National Working Group- IGCP Project-493,
Kolkata.

Member, National Working Group IGCP-509, Kolkata.

Executive Editor, *The Palaeobotanist* published by the
BSIP.

Joint Editor, BSIP Newsletter & Miscellaneous
Publications, BSIP.

Editor, Journal *Earth Science India* published by the
Society of Earth Scientists.

Member, Institutional Animal Ethics Committee of IITR,
Lucknow.

Convener, Research Development Cell, BSIP.

Course Co-ordinator, *Sedimentology and Sequence
Stratigraphy*, BSIP.

Organising Secretary, *Conclave on Evolution: Life's
Continuum*, BSIP.

Organising Secretary, *International Field Workshop on
Vindhyan Basin. Son Valley Area, Central India*,
PSI, Lucknow.

External Examiner, M.Sc. Geology, Second Semester,
AMU, Aligarh.

Alpana Singh

Member, Bureau of Indian Standards, Solid Mineral Fuel
Sectional Committee- PCD-7.4: Methods of Analysis
Subcommittee.

Member, The Society for Organic Petrology (TSOP).

B.D. Singh

Associate Member, International Committee for Coal and
Organic Petrology (ICCP).

Principal Member, Bureau of Indian Standards, Solid
Mineral Fuel Sectional Committee- PCD-7.4:
Methods of Analysis Subcommittee.



Member, Research Planning and Coordination Cell, BSIP.

Member, Coordination Committee for the establishment of Birbal Sahni Memorial Fossil Park and Museum, Dept. S&T, Govt. of Jharkhand, Ranchi.

Member, Paper Setter Panel (for I M.Tech.), on Coal & Coalbed Methane Exploration (Session 2009-10), Indian School of Mines, Dhanbad.

Member, Board of Examiners (Ph.D. Thesis), Vinoba Bhave University, Hazaribagh.

Rashmi Srivastava

Editor, *Geophytology* (since January 2009).

Councilor, Executive Council, The Palaeobotanical Society, Lucknow.

Rajni Tewari

Member, Smart Administration Cell, BSIP.

Convener, Women's Forum, BSIP.

S.K.M. Tripathi

Councilor, Executive Council, The Palaeobotanical Society, Lucknow (till December 2009).

C.M. Nautiyal

Member (Outstation) Executive, Vigyan Parishad, Prayag.

Member, Project Evaluation/Review Committee, Uttarakhand Council of S&T, Dehradun.

Member, Technical Committee, Rashtriya Yuva Vaigyanik Sammelan, Uttarakhand.

Advisor, Coordination Committee, National Children's Science Congress, Uttar Pradesh.

Member, Uttar Pradesh Council for S&T Committee for Science Park, Hardoi.

Member, Organising Committee, SCIENCE EXPO-2010 at Regional Science City.

Member, Selection Committee for TA (E) at Regional Science City, Lucknow.

Member, Selection Committee for Best State Coordinator of NCSC-2009 (Ahmedabad).

Judge, Creative Product Making, Regional Science City on World Heritage Day (April 18, 2010)

A Judge for the Rajbhasha entrees at Lalit Kala Akedemi, Regional Centre, Lucknow/

Member, National Executive Committee, The Society of Earth Scientists.

Anjum Farooqui

Executive Member, International Society of Plant and Environment, NBRI, Lucknow

Member, Working Group, International Geological Correlation Programme (IGCP-495)

A.K. Ghosh

Judge, National Children's Science Congress (District level) at S.K.D. Academy, Rajajipuram, Lucknow (October 24, 2009).

Member, Organising Committee, *Conclave on Evolution: Life's Continuum*, BSIP

Ratan Kar

Convener, Conference on *Climatic Changes during the Quaternary: Special reference to Polar Regions and Southern ocean* (October 2009).

Administrative Personnel

S.C. Bajpai

Chairperson, Technical Session, Society for Energy Engineers & Managers, Uttar Pradesh Workshop Series, Lucknow (Sept. 2009).

Group Leader, Society for Energy Engineers & Managers' Uttar Pradesh State Level ECBC Sub-Committee on Lighting and HVAC Systems, Lucknow.

Chairperson, Plenary Session on Energy Policy, Transition to Renewable Energy and Energy Efficiency & Conversion, National Conference on Renewable Energy, Jodhpur (Nov. 2009).

Judge, Create your Taste/Model Making Event of the National Geography Olympiad, GEOFEST International-2009, CMDC, Kanpur Road, Lucknow (Nov. 09, 2009).

Judge, Debate Competition, 12th International Convention of Students Quality Control Circles-2009, City Montessorie Degree College, Lucknow (Dec. 04, 2009).

Chairman, Technical Session V, 2nd National Conference on Nonomaterials and Nanotechnology, Lucknow (Dec. 2009).

Guest Faculty, M.Sc. Programme on Renewable Energy, Department of Physics, University of Lucknow, Lucknow.

Doctoral Degree Awarded

Name	Subject	Date	University	Supervisor	Title of Ph.D. Thesis
Divya Srivastava	Botany	January 05, 2010	Lucknow University	Dr. S.K.M. Tripathi	Palynological investigations, facies analysis and palaeoenvironmental interpretations of Palaeocene to Eocene sequences of western India.
Jyoti Sharma	Geology	June 25, 2009	Lucknow University	Prof. I.B. Singh A. Bhattacharyya	Palaeoclimatic analysis since Late Pleistocene from monsoon and non-monsoon climatic zones of Himalayan region.



Overseas scientists offering obeisance on the Samadhi of Prof. Birbal Sahni on Founder's Day

Units

Publication

Journal— *The Palaeobotanist*

Volume 58 of BSIP’s flagship peer-reviewed journal *The Palaeobotanist* was published with state of the art printing technology. Papers for the Volume 59 are under process.

BSIP Newsletter

Annual BSIP Newsletter 2009 (No. 12) was published with information on important activities of the Institute during the period July 2008 to June 2009.

Annual Report

English and Hindi versions of Annual Report were published incorporating the research work carried out in different research projects during the period 2008-2009. Conference participation, awards, research papers published/ accepted, Foundation/ Founders’ Day celebrations, reports of different units, annual accounts and related aspects with relevant graphics and photographs were also published.

Book

A full-coloured book was published containing speaker’s profile and abstracts of lectures delivered during the *Conclave on Evolution: Life’s Continuum* organized by the Institute on November 15, 2009 to celebrate Charles Darwin’s Bicentennial Birth Anniversary and

sesquicentennial Anniversary of his book *Origin of Species*.

Booklet on Lectures

A booklet on lectures given by eminent scientists during *Sedimentology and Sequence Stratigraphy Training Programme* organized by the Institute during October 26-31, 2009 was compiled.

Handouts— Following biographical profiles and themes of lecture of eminent speakers delivered on the occasion of Foundation Day, Founders’ Day and other special events were published:

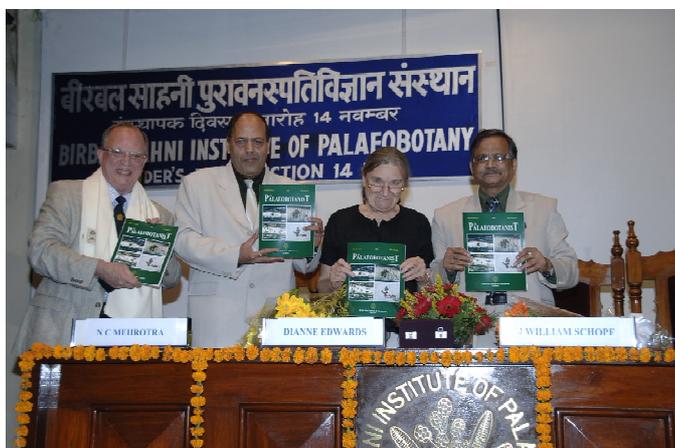
Dr. Shailesh Nayak — *Towards Climate Information and Services* (13th Jubilee Lecture, September 2009)

Prof. J. William Schopf — *The earliest History of Life: Solution to Darwin’s Dilemma* (55th Sir AC Seward Memorial Lecture, November 2009)

Prof. Dianne Edwards — *Tracing ‘Roots’ in early Terrestrial Ecosystems* (39th Birbal Sahni Memorial Lecture, November 2009)

Dr. V.P. Dimri — *Geological Sequestration of CO₂ for Enhanced Oil Recovery* (4th Diamond Jubilee Lecture, January 2010)

Invitation Cards— Invitation cards for Foundation Day, Founders’ Day, and Conclave on Evolution were printed.



A view of release of publications during Founder's Day 2009

Library

Library and Information services at BSIP play an important role in facilitating the creation of new knowledge through the acquisition, organization and dissemination of library materials.

The current holdings of library are as under:

Particulars	Additions during 2009-10	Total
Books	26	5,848
Journals (bound volumes)	254	15,864
Reprints	49	40,079
Reference Books	-	339
Hindi Books	1	368
Ph.D. Thesis	-	91
Reports	-	46
Maps & Atlases	-	61
Microfilm/ Fisches	-	294
CD	-	74

Currently the library is receiving 167 journals (95 through subscription and 72 through exchange). There are 153 registered card holders using the library facilities.

Exchange Facility

Institutions on exchange list	58
Individuals on exchange list	146
Journals received on exchange basis	72
Reprints sent out in exchange	767
Reprints of research papers purchased for exchange	20

Institute's Annual Report and Newsletter have been sent to individuals and various organizations.

Automation

Entire literature of the library is in Libsys software, the integrated library automation software that enables working in integrated multi-user and networked environment. Activities like circulation, catalogueing, serials control, binding management are carried out through this software. The holdings are accessible by a computerized on-line catalogue OPAC (Online Public Access Catalogue). OPAC is searchable by author, title, subject, call number, and keyword.

e-Journals

Web based access of the journals is available over the Institute LAN from the following publishers– Science

Direct, through CSIR-DST Consortium: Cambridge, Indian Journals, IOP Science, JCCC@INSTIRC, Nature, Oxford, Science, Springer, Taylor and Francis, Web of Science. In addition, trial access from ALPSP Learned Journals Collection, GIST Find, Royal Society, Wiley-Blackwell was provided.

Other Facilities

Current Awareness Service— To keep readers in touch with the latest arrivals in the library, contents of the journals displayed every month are collated and presented in the form of a volume “New Arrivals”.

Lamination— To preserve the old and rare literatures, lamination and xerox of such publications was done.

Xeroxing— Xerox facility was provided to institute scientists as well as to out side scientists/ organizations.

Inter-Library Loan Service— This facility is provided to users on request.

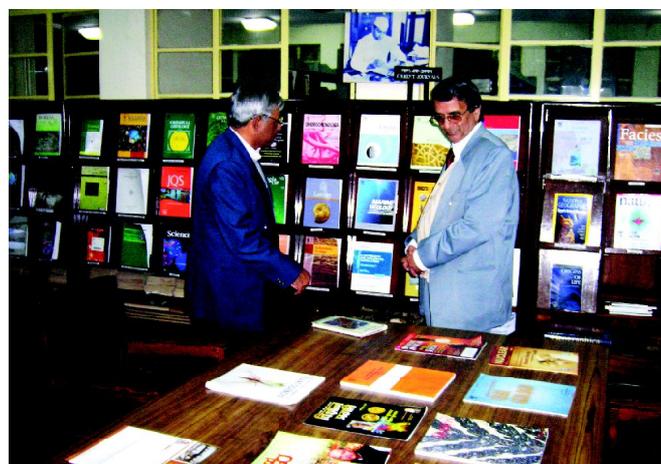
The following Institutions/Organizations availed the library facilities:

Departments of Botany, and Geology, Lucknow University, Lucknow, Uttar Pradesh

Department of Botany, Sant Gadge Baba Amravati University, Amravati, Maharashtra

Career Post Graduate Institute of Dental Sciences and Hospital, Lucknow, Uttar Pradesh

Department of Earth Sciences, IIT, Mumbai, Maharashtra
Mahatma Gandhi Chitrakoot Gramodaya Vishwa-vidyalaya, Chitrakoot, M.P.



Dr. V.P. Dimri, Director, National Geophysical Research Institute, Hyderabad visiting the Institute's Library



Museum

The Museum is a nodal center for popularizing and dissemination of palaeobotanical knowledge. The institute displayed its activities at Science City, Aliganj, Lucknow on the occasion of Science Expo from January 28 to February 01, 2010.

Work on 'Type and Figured specimens at the Repository: An Inventory, has been completed and the document is ready for publication.

Research materials collected by the scientists of the Institute from 233 localities of the country under different projects, DST sponsored projects and collaborative researches are deposited in the museum. Details of additions to the type and figured specimens/ slides/ negative are as follows:

Particulars Type	Addition during 2009-2010	Total
Type and figured specimens	245	7,571
Type and figured slides	267	13,423
Negatives of above	60	17,671

Holdings

Samples/specimens collected by the scientists and deposited in the Museum for investigation are as under:

Project	Specimens	Samples
Project- 1	-	283
Project- 2	463	138
Project- 3	-	611
Project- 4	1163	92
Project- 5	-	692
Project- 6	-	276
Project- 7	-	88
Project- 9	-	758
Project- 11	-	42
Project- 12	-	989
Project- 13	-	532
Project- 14	46	303

Samples deposited under Sponsored/ Collaborative Projects:

ONGC Sponsored	286
International Workshop	45
DST Sponsored (No. SR/S4/ES-264/2007)	513
DST/INT/PRC/Project-1/2008	5
Received from IIT, Mumbai	61

Fossil specimens gifted within the country to the following centers:

Department of Geology, Sri Guru Ram Rai P.G. College, Dehradun (Uttarakhand)

Pandit Deen Dayal Upadhyaya Govt. Womens P.G. College, Rajajipuram, Lucknow

Department of Botany, Vidya Sagar College, Kolkata

Bhagwant Public College, District Bijnor (Uttar Pradesh)

Mahatma Gandhi Chitrakoot Gramodaya Vishwavidyalaya, Chitrakoot, Satna(Madhya Pradesh)

Department of Botany, Shivaji University, Kolhapur (Maharashtra)

Department of Geology, V.S.N.V. P.G. College, Lucknow

Divya Shikha Balika Gyanpeeth, Sarvodaya Nagar, Lucknow

Department of Geology, Centre of Advance Study, Lucknow University, Lucknow

Institutional Visitors

Trainees of F.T.I., Kanpur

Department of Botany, Vivekanand College, West Bengal

Department of Botany, Shivaji University, Kolhapur, Maharashtra

Vidya Sagar College, Kolkata

Department of Zoology Science College, Kokrajhar, Assam

A.N.D.N.N.M.M. College, Kanpur

Department of Botany & Life Sciences, Lucknow University, Lucknow

Herbarium

About 150 plant specimens, 105 samples of leaves, 10 wood cores, 6 wood slides, 32 pollen slides and 64 samples of fruits and seeds have been added to the repository. All herbarium materials are placed in the pigeon-hole almirrah in their respective families.

Holdings

Particulars	Addition during 2009-2010	Total
Herbarium		
Plant specimens	150	23,337
Leaf specimens	105	1,167
Laminated mounts of venation pattern	-	66
Xylarium		
Wood blocks	-	4,158
Wood discs	-	68
Wood cores	10	7,390
Wood slides	6	4,284
Palm slides (stem, leaf, petiole, root.)	-	3,195
Sporothek		
Polleniferous materials	-	3,016
Pollen slides	32	12,296
Carpothek		
Fruits & seeds	64	4,318
Museum Samples		
Medicinal & Food plants	-	91

Visitors:

Dr. Ashutosh Mishra, Principal, Acharya Narendra Deo College of Pharmacy, Babhnan, Gonda
 Dr. (Miss) Neha Tiwari, Department of Pharmacy, Siddhartha Institute of Pharmacy, Dehra Dun
 Dr. Lal Babu Chaudhary & Anoop Kumar, Herbarium, NBRI, Lucknow
 Mrs. Alka Pokharia, Department of Botany, Dayanand Girls Degree College, Kanpur
 Drs. R. Ferade, M.S. Disale & D.K. Marle, College of Education, Barsh, Solapur, Maharashtra
 Sri Jaswant Singh, Forest Range Training Officer, Forest Training Institute, Kanpur
 Prof. Dinesh Kumar, Head, Department of Botany, Lucknow University, Lucknow



Electronic Data Processing

Internet Connection with Radio link facility from Software Technology Park of India, Lucknow has been upgraded upto 6 MBPS (1:1) and is running in the Institute. Proxy, Mail and DNS Servers are successfully running on Sun V440, Sun V240 having Solaris Operating System. This provides 24 hours Internet facility to the Institute Staff. At present 145 Computers are connected with the LAN.

An Anti Virus Program "Symantec Endpoint Protection 11.0" has been renewed with 150 user license to protect the systems from viruses and worms. This year Institute has procured 15 Compaq P-IV systems with UPS. Institute has renewed the license of Cyberoam CR100i Unified Threat Management (UTM) to stop the spamming, virus and unauthorized

access at the Gateway level.

Institute's web site (<http://www.bsip.res.in>) is running on the Institute's Server. Computer Section is maintaining web's day to day updation. Wireless Internet Connectivity has been running within the campus.

Payroll, Form16 and Pension packages are also modified as per the requirements. Computer Section is providing help to the scientists in preparing the multimedia presentations, charts, graphs, lithologs and diagrams for their scientific publications and documentation.

As per the guidelines recommended by VI Pay Commission, Computer Section has provided training to 21 staff members from Group 'D' during March 16-29, 2010.

Section Cutting Unit

Section Cutting is one of the units of the Institute where fossils and rock samples are cut and their thin sections are prepared. During the year more than 400 samples were cut and about 1000 slides were

prepared. In addition about 140 slices were made and polished. Besides, a number of scientists, students and teachers visited the workshop for studying section cutting.

Reservations and Concessions

The Institute is following General Reservation Orders of the Government of India as applicable to Autonomous Bodies and amended from time to time for the reservations and concessions of Scheduled Castes

(SC), Scheduled Tribes (ST), Other Backward Classes (OBC) and Physically Handicapped Persons for the posts meant for direct recruitment in Group 'A', 'B', 'C' and 'D' as per Govt. of India Orders.

Women's Forum

As per guidelines of Department of Science and Technology, the Institute has constituted the Women's Forum with representatives from Scientific

(Dr. Rajni Tewari), Technical (Dr. Madhabi Chakraborty) and Administrative (Mrs. Pennamma Thomas) staff.

Status of Official Language

BSIP is striving towards achieving the set target of official language. The institute participated in the half-yearly meetings of Nagar Rajbhasha Kaaryaanvayan Samiti (NRKS) in August 2009 and January 2010.

Hindi Fortnight

Hindi Pakhwara was inaugurated on September 14, 2009 by Mr. Naveen Joshi, Chief Resident Editor of The Hindustan newspaper with an interesting lecture on *Vijnaan evam Sampreshan*. The Director Dr. NC Mehrotra introduced the speaker and Dr. AK Srivastava proposed the vote of thanks. The Director cheered up the competitors during the competitions and the programme concluded in a good spirit. Sixty two competitors participated in the series of competitions on *Find the Errors, Essay, Noting, Antyaakshari*, and *Debate*. *Kavi Sammelan* was also organized in which three Poets of the Institute participated. Hindi books of

reputed authors were given away to the conquerors. Results of competitions are:

Find the Mistakes: I– Ms Deepa Agnihotri, II– Dr. Anju Saxena, III– Ms Aakanksha Tripathi

Essay: I– Ms Shilpa Singh, II– Dr. P.S. Ranhotra, III– Ms Sandhya Sharma

Noting: I– Mrs. Kavita Kumar, II– Mr T.K. Mandal, III– Mr. V.K. Nigam

Antyaakshari: I– Dr. Rashmi Srivastava, Ms Deepa Agnihotri; II– Ms Aakanksha Tripathi, Ms. Sandhya Sharma, III– Mr. Nilay Govind , Mr. R.K. Awasthi

Debate: I– Ms Sandhya Sharma, II– Ms Shilpa Singh, III– Mr. K.C. Chandola





Hindi Encouragement Prizes

To promote the use of official language in the Institute cash prizes were awarded to the followings:

I – Dr. Mukund Sharma, Dr. (Mrs.) Rashmi Srivastava

II – Mrs. Penamma Thomas, Mr. Madhukar Arvind, Mr. Hari Lal

III – Mrs. Shail Singh Rathore, Mr. Gopal Singh, Mr. Ajay Kumar Srivastava

Hindi Workshop

Following Hindi Workshops were organized:

Vijnaan ke Prachaar-Prasaar mein Rajbhasha ka Prayog Kaise Ho and Computer va Hindi [Dr. Anand Prakash Rai, GSI, Lucknow] on 26.06.2009

Vijnaan evam Sampreshan [Mr. Naveen Joshi, Chief Local Editor, Lucknow] on 14.09.2009

Rajbhasha Niti tatha Kaaryaanvayan [Mr. Sanjay Kumar Pandey, HAL, Lucknow] on 18.12.2009

Swasth Jeevan ke Praktik Rahasya [Dr. S. Choramani Gopal, Vice- Chancellor, CSM Medical University, Lucknow] on 25.02.2010

Deputation to Workshops

Mrs. Ruchita Bose & Mr. Ashok Kumar (on 29.6.2009); Mr. S.K. Basumatari, Mr. J. Baskaran & Mr. Avinash Kumar Srivastava (on 30.6.2009); Mrs. Penamma Thomas & Mr. Ashok Kumar (on 22.12.2009); Dr. A. Rajanikanth, Dr. B. Sekar & Mrs. Swapna Majumdar (on 23.12.2009) attended two day's *Hindi Workshops* conducted by Nagar Rajbhasha Kaaryaanvayan Samiti, Lucknow.

Miscellaneous

Computers of the Institute have been facilitated with bilingual (software). Annual Report of the Institute was published in Hindi. Abstracts of the research papers were also published in the International Journal of the Institute. Thus, the Institute strives to abide by the rules and direction of the Official Language *in extenso*.

The Director, BSIP addressed the Institute staff in Hindi on various social functions. The visiting students from various schools on Science Day were also addressed in Hindi. Dr. C.M. Nautiyal gave over a dozen lectures on science subjects in Hindi in various institutions, universities and academies in Lucknow, Allahabad, Barabanki, Bagpat, and Srinagar. Dr. (Ms.) Vartika Singh delivered a lecture at P.M.S., Lucknow in Hindi. Dr. C.M. Nautiyal delivered lectures on *Soorya Grahan* (Solar Eclipse) and *Brahmaand mein Jeevan* (Life in Universe) at Regional Science City and Central Institute of Medicinal & Aromatic Plants, Lucknow respectively.

Staff

Director

Dr. Naresh C. Mehrotra

Scientists

Scientist 'G'

Dr Ashwini K. Srivastava

Scientist 'F'

Dr (Mrs) Usha Bajpai
 Dr Rahul Garg
 Dr Jaswant S. Guleria
 Dr (Mrs) Neerja Jha
 Dr (Mrs) Asha Khandelwal (retired w.e.f. 31.08.2009)
 Dr Ramesh K. Saxena
 Dr (Mrs) Archana Tripathi (retired w.e.f. 31.07.2009)
 Dr (Ms) Vijaya
 Dr Ram R. Yadav

Scientist 'E'

Dr Anil Agarwal (retired w.e.f. 31.07.2009)
 Dr Rupendra Babu
 Dr Samir K. Bera
 Dr Amalava Bhattacharyya
 Dr Mohan S. Chauhan
 Dr (Ms) Asha Gupta
 Dr Brajendra N. Jana (retired w.e.f. 30.06.2009)
 Dr Khowaja Ateequzzaman (retired w.e.f. 31.12.2009)
 Dr Madhav Kumar
 Dr Rakesh C. Mehrotra
 Dr Mahesh Prasad
 Dr (Mrs) Jyotsana Rai
 Dr Annamraju Rajanikanth
 Dr Ram Awatar
 Dr Mulagalapalli R. Rao
 Dr Dinesh C. Saini
 Dr Omprakash S. Sarate
 Dr Samir Sarkar
 Dr Rakesh Saxena
 Dr Mukund Sharma
 Dr (Mrs) Alpana Singh
 Dr Bhagwan D. Singh
 Dr Kamal J. Singh
 Dr Rama S. Singh
 Dr (Mrs) Chanchala Srivastava
 Dr (Mrs) Rashmi Srivastava
 Dr (Mrs) Rajni Tewari
 Dr Surya K.M. Tripathi

Scientist 'D'

Dr Supriya Chakraborty (on lien- resigned w.e.f. 01.09.2009)
 Dr (Mrs) Anjum Farooqui
 Dr Amit K. Ghosh
 Dr Bhagwan D. Mandaokar
 Dr Kindu L. Meena
 Dr Chandra M. Nautiyal
 Dr (Mrs) Neeru Prakash
 Dr (Mrs) Vandana Prasad
 Dr Anupam Sharma
 Dr Gyanendra K. Trivedi

Scientist 'C'

Dr. Ratan Kar
 Dr (Mrs) Binita Phartiyal

Scientist 'B'

Mr Sadhan K. Basumatary
 Mr Krishna G. Misra
 Dr Srikanta Murthy
 Mr S. Suresh K. Pillai
 Dr Parminder S. Ranhotra
 Dr (Mrs) K. Pauline Sabina
 Dr (Mrs) Anju Saxena
 Dr Santosh K. Shah
 Dr Hukam Singh
 Dr (Ms) Vartika Singh
 Mr Veeru K. Singh
 Mr Biswajeet Thakur

Scientist 'A'

Dr Anil K. Pokharia

Birbal Sahni Research Associate

Mr. Om Prakash

Birbal Sahni Research Scholar

Ms Deepa Agnihotri
 Ms Neha Goel
 Ms Nivedita Mehrotra (resigned w.e.f. 01.08.2009)
 Mr Mohamad Firoze Quamar
 Mrs Anumeha Shukla
 Mrs Abha Singh
 Ms Deepti Singh (resigned w.e.f. 13.04.2009)
 Mr. Gaurav Kr. Singh
 Ms Shilpa Singh

(The names are in alphabetical order according to 'surnames')



Technical Personnel

Technical Officer 'D'

Dr B. Sekar

Technical Officer 'C'

Mr P.K. Bajpai

Dr (Mrs) Madhabi Chakraborty

Mrs Indra Goel

Mr P.S. Katiyar

Dr E.G. Khare

Mr T.K. Mandal

Mr V.K. Singh

Technical Officer 'B'

Mrs Reeta Banerjee

Mrs Sunita Khanna

Mrs Kavita Kumar

Mr Chandra Pal

Mr Prem Prakash

Mr V.P. Singh

Mr Y.P. Singh

Mr Avinesh K. Srivastava

Technical Officer 'A'

Mr Madhukar Arvind

Mr Subodh Kumar

Mr R.L. Mehra

Mr R.C. Mishra

Mr Pradeep Mohan

Mr V.K. Nigam

Mr Keshav Ram

Technical Assistant 'E'

Mr Chandra Bali

Technical Assistant 'D'

Mr S.R. Ali

Mr D.S. Bisht

Mr Sumit Bisht

Mr. S.K. Bisht

Mr. Nilay Govind

Mr D.K. Pal

Mr Dharendra Sharma

Ms Kirti Singh

Dr S.K. Singh

Mr C.L. Verma

Dr S.M. Vethanayagam

Technical Assistant 'B'

Mr Avanish Kumar

Mr M.S. Rana

Mr S.C. Singh

Mr Ajay K. Srivastava

Technical Assistant 'A'

Mr. J. Baskaran

Mr Pawan Kumar

Mr Om Prakash

Mr. A.K. Sharma

Ms Richa Tiwari

Mr. Ram Ujagar

Administrative Personnel

Registrar: Dr Suresh C. Bajpai

Accounts Officer: Mr Dipak K. Dutta (on lien)

Private Secretary: Mrs M. Jagath Janani

Section Officer

Mr R.K. Kapoor

Mrs V. Nirmala

Stenographer: Sri Murukan Pillai

Assistant

Mrs Ruchita Bose

Mr Hari Lal

Mrs Swapna Mazumdar

Mr Gopal Singh

Mr K.P. Singh

Mr Koshy Thomas

Mrs Pennamma Thomas

Hindi Translator: Mr Ashok Kumar

Upper Division Clerk

Ms Chitra Chatterjee

Mr Mishri Lal

Mr S.S. Panwar

Mr Rameshwar Prasad

Mrs Shail S. Rathore

Mr Avinash K. Srivastava

Mrs Renu Srivastava

Mr N.Unni Kannan

Lower Division Clerk

Ms Sudha Kureel

Ms Manisha Tharu

Driver

Mr Nafis Ahmed ('IV')

Mr D.K. Mishra ('III')

(The names are in alphabetical order according to 'surnames')



Mr M.M. Mishra ('III')
Mr V.P. Singh ('III')
Mr P.K. Mishra ('II')

Class 'D' Personnel

Attendant 'IV' (Technical)
Sri K.C. Chandola

Attendant 'III'
Sri Kesho Ram
Sri Haradhan Mahanti
Smt. Munni
Sri Prem Chandra
Sri Ram Deen
Sri Ram Singh
Sri Shree Ram

Attendant 'II'
Sri K.K. Bajpai
Smt. Maya Devi
Sri Hari Kishan
Sri Kailash Nath
Sri Dhan B. Kunwar
Sri Mani Lal Pal
Sri Ram Dheeraj
Sri Mohammad Shakil
Sri Bam Singh
Sri Kedar N. Yadav

Attendant 'I'
Sri R.K. Awasthi

Smt. Beena
Sri Deepak Kumar
Sri Vishwanath S. Gaikwad
Sri Inder Kumar
Km. Nandani
Smt. Ram Kali
Sri Ramesh Kumar
Sri Ravi Shankar

Mali
Sri Rameshwar Prasad Pal ('III')
Sri Ram Chander ('I')
Sri Ram Kewal ('I')
Sri Mathura Prasad ('I')

Sponsored Project Personnel

Dr Shantanu Chatterjee, RA (tenure ended w.e.f. 15.02.2010)
Mrs Poonam Verma, SRF (tenure ended w.e.f. 31.07.2009)
Mr Kamlesh Kumar, SRF
Mr. Harinam Joshi, JRF
Mr. Mayank Shekhar, JRF
Mr. Vinayak Srivastava, JRF (resigned w.e.f. 02.04.2009)
Ms Swati Dixit, Project Assistant
Mr Gaurav Srivastava, Project Assistant
Mr Saheb Lal Yadav, Lab Assistant (tenure ended w.e.f. 14.01.2010)
Mr. Ram Ketar, Field Assistant (tenure ended w.e.f. 15.02.2010)

(The names are in alphabetical order according to 'surnames')

Appointments

Mr. Nanda Ballabh Tewari, Accounts Officer (on deputation) w.e.f. 21.12.2009 (FN)	Mr Kanud Kumar Gupta, Junior Research Fellow w.e.f. 10.06.2009 (FN)
Mr. Rajesh Kumar Mishra, Lower Division Clerk w.e.f. 20.04.2009 (FN)	Mr Kaushal Kishore Singh, Junior Research Fellow w.e.f. 08.07.2009 (FN) tenure expired w.e.f. 15.02.2010
Ms Jyoti Verma, Senior Research Fellow w.e.f. 02.04.2009 (FN) resigned w.e.f. 25.07.2009 (FN)	Mr Suman Sarkar, Junior Research Fellow w.e.f. 31.07.2009 (FN)
Ms Sandhya Sharma, Junior Research Fellow w.e.f. 02.04.2009 (FN)	Mr. Kanud Kumar Gupta, Junior Research Fellow w.e.f. 10.06.2009 (FN)
Ms Jyoti Srivastava, Junior Research Fellow w.e.f. 20.05.2009 (FN)	Ms Archana Singh, Project Assistant w.e.f. 20.04.2009 (FN)

AUDIT REPORT

**to the
Governing Body
of the
Birbal Sahni Institute of Palaeobotany
Lucknow**

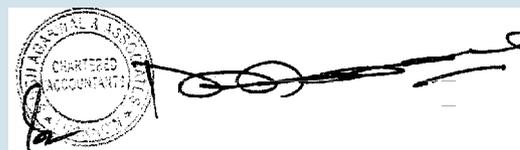
We have audited the attached Balance Sheet of Birbal Sahni Institute of Palaeobotany, Lucknow, as at 31st March 2010 and also the Income & Expenditure account and Receipt & Payment account for the year ended on that date annexed thereto. These financial statements are the responsibility of the Institute's management. Our responsibility is to express an opinion on these financial statements based on our audit.

We conducted our audit in accordance with auditing standards generally accepted in India. Those Standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement. An audit includes examining, on a test basis, evidence supporting the amounts and disclosures in the financial statement. An audit also includes assessing the accounting principles used and significant estimates made by management, as well as evaluating the overall financial statement presentation. We believe that our audit provides a reasonable basis for our opinion.

Further to our comments in the Annexure "A" attached, we report that :

- (i) We have obtained all the information and explanations, which to the best of our knowledge and belief were necessary for the purpose of our audit;
- (ii) In our opinion, proper books of account as required by law have been kept by the Institute so far as appears from our examination of those books;
- (iii) The Balance Sheet and Income & Expenditure account and Receipt & Payment account dealt with by this report are in Agreement with the books of account;
- (iv) In our opinion and to the best of our information and according to the explanations given to us and the said account give the information, in the manner so required, and give a true and fair view in conformity with the accounting principles generally accepted in India;
 - a) In the case of the Balance Sheet, of the state of affairs of the Institute as at 31st March, 2010;
 - b) In the case of the Income & Expenditure Account, of the surplus/deficit for the year ended on the date, and
 - c) In the case of Receipt & Payment Account, of the receipts & payments of the Institute for the year ended on that date.

For Singh Agarwal & Associates
Chartered Accountants



Mukesh Kumar Agarwal
FCA, DISA (ICAI)
Partner
Membership No. 073355

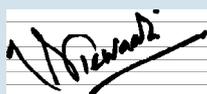
Place : Lucknow
Date : 16th November, 2010

ANNEXURE - 'A'

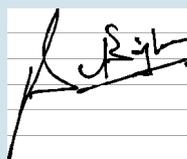
(Annexed to and forming part of the Audit Report for the year ended 31st March, 2010)
**Comments/Audit observations on accounts of Birbal Sahni Institute of Palaeobotany- Lucknow
for the year ended 31st March, 2010**

S No	Comments/Observations by the Chartered Accountants	Actions taken by the Institute																					
01.	The Institute is getting separate grants for Plan & Non-Plan expenses based on the budgets approved by the DST. During the year under report, the Institute has allowed to use Plan head for Salary instead of Non-Plan budget.	Since all scientific and technical staff members are involved in the Plan activities, as per Governing Body's resolution, their salary and allowances are debited to the Plan Head with the prior approval of the GB.																					
02.	<p>Advances (capital head) unsettled and pending for recovery/adjustment as on 31.03.2010 under different heads, since long, are to be properly taken care of at the Institute level for early adjustment. Details of which are as under :</p> <table border="1"> <thead> <tr> <th>Particulars</th> <th>Year</th> <th>Amount</th> </tr> </thead> <tbody> <tr> <td>Works & Building (CPWD for CNR Building)</td> <td>Before FY 2007-08</td> <td>1215805/-</td> </tr> <tr> <td>Research Apparatus & Equipments</td> <td>Before FY 2007-08</td> <td>2436558/-</td> </tr> <tr> <td>Books & Journals</td> <td>2006-07</td> <td>216/-</td> </tr> <tr> <td></td> <td>2007-08</td> <td>15951/-</td> </tr> <tr> <td></td> <td>2008-09</td> <td>45210/-</td> </tr> <tr> <td></td> <td>2009-10</td> <td>8387840/-</td> </tr> </tbody> </table>	Particulars	Year	Amount	Works & Building (CPWD for CNR Building)	Before FY 2007-08	1215805/-	Research Apparatus & Equipments	Before FY 2007-08	2436558/-	Books & Journals	2006-07	216/-		2007-08	15951/-		2008-09	45210/-		2009-10	8387840/-	<p>CPWD has handed over the tube-well to the Institute after several efforts. Now, we have requested the CPWD to settle the advance immediately.</p> <p>All the equipments have been installed. Accordingly, the advances are being settled.</p> <p>Efforts are being made for supply of books and journals by the Firms.</p>
Particulars	Year	Amount																					
Works & Building (CPWD for CNR Building)	Before FY 2007-08	1215805/-																					
Research Apparatus & Equipments	Before FY 2007-08	2436558/-																					
Books & Journals	2006-07	216/-																					
	2007-08	15951/-																					
	2008-09	45210/-																					
	2009-10	8387840/-																					
03.	The Institute Authorities are advised to keep liability towards 'Earnest Money' as per final accounts duly reconciled and updated list be prepared and put on record.	The Earnest Money liability has been identified and is being put on record.																					
04.	The Institute, even though started the process of convergence to 'double entry system of accounting' for more effective and meaningful maintenance of accounting records but due to reasons beyond control, the same is delayed and yet to be got implemented. The Institute must commit and make dedicated effort with time bound implementation schedule to implement the same within the remaining period of FY 2010-11 itself.	The implementation of double entry system of accounting is likely to be completed within the FY 2010-11.																					
05.	Maintenance of accounting records, Cash/Bank Book, Ledgers (including stores records) etc need to be strengthened and cutting and over-writings must be duly authenticated. Reconciliation of Ledger balance is required to be made on regular basis.	The cuttings and over-writings in cash books/ledgers are being authenticated as pointed out by the auditor. Henceforth, the reconciliation of ledger balances will be done on regular basis.																					
06.	The Institute has invested most of the funds into the Term Deposits with banks and financial institutions. The Institute is following cash basis of accounting. However, the Institute is advised to account for TDS on these investments. If any, on yearly basis and claim with the Income Tax Department accordingly. Miscellaneous income of the Institute is shown as net of TDS. It is emphasized that it would be prudent to show the same Gross of TDS & TDS amount be shown separately.	The advice of auditors is being complied.																					

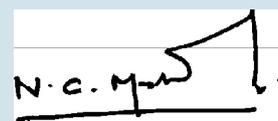
S No	Comments/Observations by the Chartered Accountants	Actions taken by the Institute
07.	<p>Library</p> <p>As per the defined Rules Physical Verification of the Library was to be carried out at an interval of every 2 years, as reported. No such verification schedule or working papers produced during the year under audit. It appears that the same is pending for the year 2007-08 and onwards.</p>	<p>The physical verification of the Library for the years 2007-08 and 2008-09 is under process.</p>
08.	<p>Publication</p> <p>On scrutiny of records of the priced publication of the Institute, it has been observed that during last several years, the Institute had brought-out publications on different subjects with an objective to sell-out the same, in the market. The stock position of these priced publications as on 31.03.2010 was ₹ 43.25 Lakhs apart from the reserved stock of ₹ 6.68 Lakhs. Thus, the total stock of the publications stood at ₹ 49.93 Lakhs at the close of the year, which seems to be on higher side. A practical assessment has to be made for the quantity to be got printed together with its economics etc, so that wastage and blockage of funds can be avoided.</p>	<p>Concerted efforts are being made to reduce the stock of priced publications by donating them to Institutions of Higher Learning in the country with the approval of the Governing Body after reserving necessary stock.</p>
09.	<p>Stores</p> <p>The Fixed Assets register and Stores register are NOT being maintained properly. Physical verification was to be carried out during the year under audit. As per Inter-office memorandum letter dated 05.09.2009, a Committee was constituted for the purpose, but no progress in this regard has been noticed. It has been informed to us that the job of physical verification is continuing and will be completed soon. Effective and timely conduct of physical verification should be the prime concern of the said Committee to make exercise fruitful.</p>	<p>The physical verification of most of the stores has been completed and further action is under process.</p>
10.	<p>Employees Provident Fund (GPF/ CPF)</p> <p>The investment of ₹ 124800/- unadjusted amount of premium paid on RBI Bonds, which were redeemed in the year 2006-07 and remains pending for suitable adjustments.</p>	<p>The matter has been discussed in the F&B Committee and Governing Body meetings. The Investment Committee of the Institute has recommended for booking ₹ 124800/- as an expenditure on revenue in the balance-sheet instead of the investment.</p>
11.	<p>CPF funds are kept invested by the Institute along with GPF funds and require to be dealt with according to the rules in this regard by depositing the same with concerned Statutory Authorities. Institute must make effective efforts/steps in completing the remaining formalities for the same.</p>	<p>Action to deposit the investment of CPF funds with the Statutory Authorities is in process.</p>



(N B Tiwari)
Accounts Officer



(pai)
Registrar



(Naresh C. Mehrotra)
Director

Birbal Sahni Institute of Palaeobotany, Lucknow

Balance Sheet as at March 31, 2010

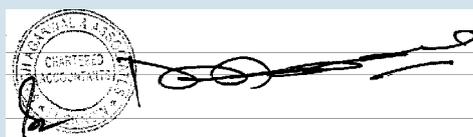
Fig. in Rupees

CORPUS/CAPITAL FUND AND LIABILITIES	Schedule	Current Year	Previous Year
CORPUS/CAPITAL FUND	1	149043685	152007756
RESERVES AND SURPLUS	2	25960903	20960903
EARMARKED/ENDOWMENT FUNDS	3	127975744	101053748
SECURED LOANS AND BORROWINGS	4	0	1000
UNSECURED LOANS AND BORROWINGS	5	0	0
DEFERRED CREDIT LIABILITIES	6	0	0
CURRENT LIABILITIES AND PROVISIONS	7	149119	135449
TOTAL		303129451	274158856
ASSETS			
FIXED ASSETS	8	117067458	121173181
INVESTMENTS-FROM EARMARKED/ENDOWMENT FUNDS	9	127739216	100437008
INVESTMENTS-OTHERS	10	31019444	24402400
CURRENT ASSETS, LOANS, ADVANCES ETC.	11	27303333	28146267
MISCELLANEOUS EXPENDITURE (to the extent not written off or adjusted)			
TOTAL		303129451	274158856
SIGNIFICANT ACCOUNTING POLICIES	24		
CONTINGENT LIABILITIES AND NOTES ON ACCOUNTS	25		

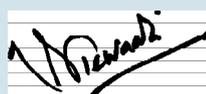
CERTIFICATE

Certified that the figures of Assets as shown in the Balance Sheet have been reconciled with the total figure of Assets shown in the relevant Registers of the Institute.

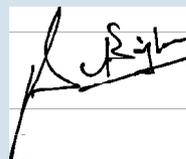
For Singh Agarwal & Associates
Chartered Accountants



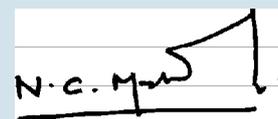
Mukesh Kumar Agarwal
(Partner)



(N B Tiwari)
Accounts Officer



(Registrar)



(Naresh C. Mehrotra)
Director

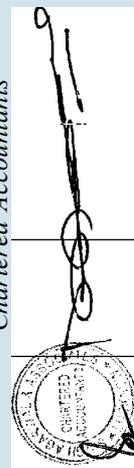
Birbal Sahni Institute of Palaeobotany, Lucknow

Income and Expenditure Account for the year ending March 31, 2010

Fig. in Rupees

INCOME	Schedule	Current Year	Previous Year
Income from Sales/Services	12	712649	1054793
Grants/subsidies (OB, Deposit A/C and Transfer from Cap. Fund)	13	198222158	102630000
Fees/Subscriptions	14	252831	0
Income from Investments (Income on Invest. From earmarked/endow. Funds transferred to Funds)	15	1617044	1511155
Income from Royalty, Publication etc.	16	196961	169114
Interest Earned	17	1467354	1092743
Other Income/adjustments	18	510609	501498
Increase/(decrease) in stock of Finished goods and works-in-progress	19	0	0
TOTAL (A)		202979606	106929303
EXPENDITURE			
Establishment Expenses	20	144552125	100130504
Other Administrative Expenses etc.	21	23609039	24188009
Expenditure on Grants, Subsidies etc.	22	0	0
Interest	23	0	0
Depreciation (Net Total at the year-end-corresponding to Schedule 8)		19417735	18640153
TOTAL (B)		187578899	142928666
Balance being excess of Income over Expenditure A B		15400707	(35999362)
Transfer to Special Reserve (Specify each)		5000000	0
Transfer to/from General Reserve to Pension Fund		14000000	7430000
BALANCE BEING SURPLUS/DEFICIT CARRIED TO CORPUS/CAPITAL FUND		(3599293)	(43399362)
SIGNIFICANT ACCOUNTING POLICIES	24		
CONTINGENT LIABILITIES AND NOTES ON ACCOUNTS	25		

Chartered Accountants



Mukesh Kumar Agarwal
(Partner)



(N B Tiwari)
Accounts Officer



(S...)
Registrar



(Naresh C. Mehrotra)
Director

Birbal Sahni Institute of Palaeobotany, Lucknow
Receipts and Payments Account for the year ended March 31, 2010

Fig. in Rupees

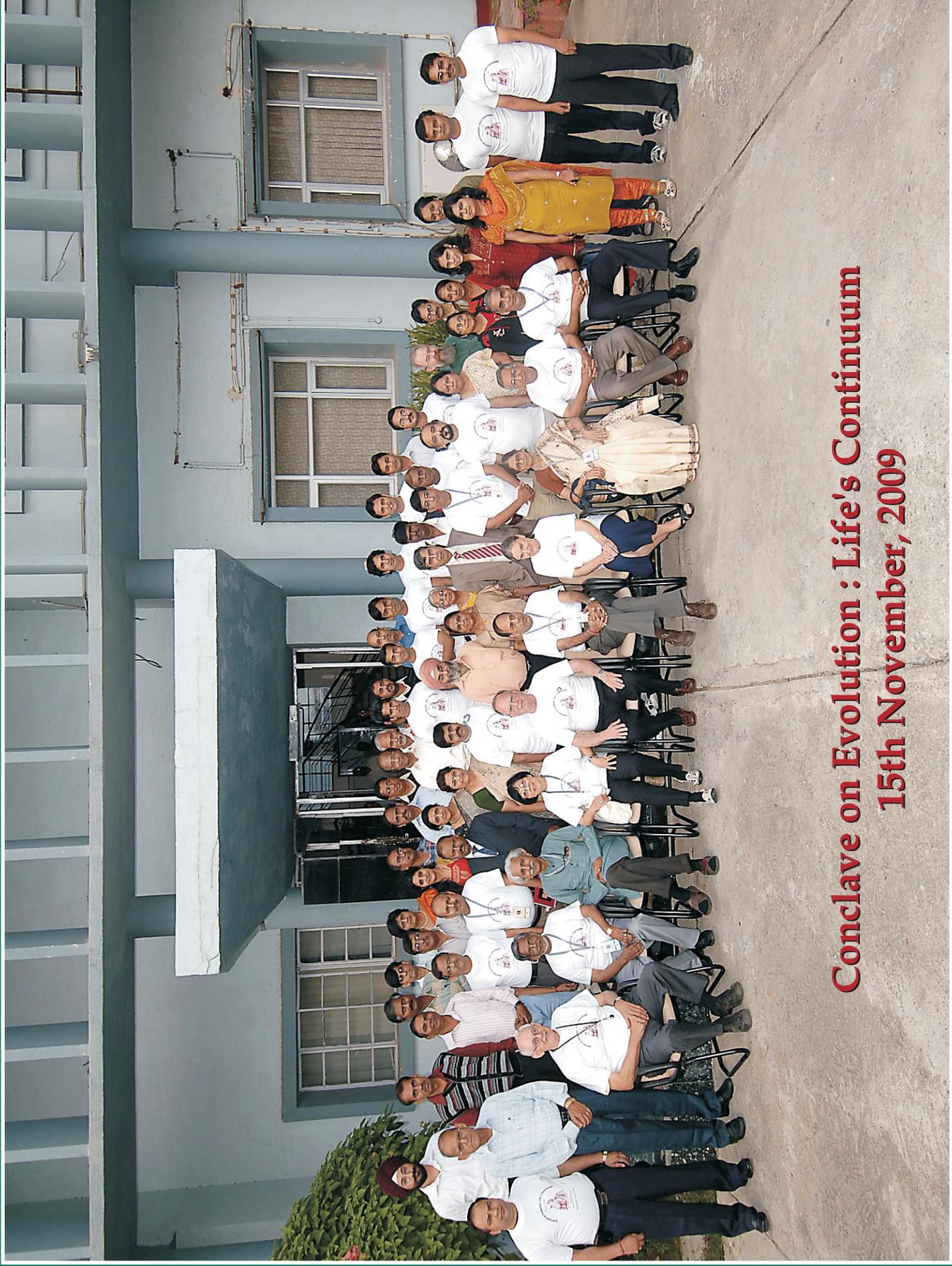
RECEIPT		Current Year	Previous Year	PAYMENTS		Current Year	Previous Year
I. Opening Balances				i) Expenses			
a) Cash in hand		102	68	a) Establishment Expenses (Corresponding to Schedule 20)		144552125	100100504
b) Bank Balances				b) Administrative Expenses (Corresponding to Schedule 21)		23609039	24188008
i) In current accounts		-73993	35/37202				
ii) In deposit accounts							
iii) Endowment deposits							
iv) Salary Account		138131	59368				
II. Grants Received				II) Payments made against funds for various projects (Name of the fund or project should be shown along with the particulars of payments made for each project)			
a) From Government of India		198222158	102600000				
b) From State Government							
c) From other sources (details)							
(Grant for capital & revenue exp. To be shown separately)							
d) Deposit Account							
III. Income on Investment from				III. Investments and deposits made			
a) Earmarked/Endow. Funds				a) Out of Earmarked/Endowment funds			
b) Own Funds (Utilized)				b) Out of Own Funds (Investments-Others)		19000000	7400000
IV. Interest Received				IV. Expenditure on Fixed Assets & Capital Work-in-Progress			
a) On Bank deposits		683816	562123	a) Purchase of Fixed Assets		3805989	23633301
b) Loans, Advances etc.		783338	530620	b) Expenditure on Capital Work-in-Progress			
V. Other Income (specify)				V. Refund of surplus money/Loans			
i) Sale proceeds of Publications		196961	169114	a) To the Government of India			
ii) Miscellaneous Income		492157	427096	b) To the State Government			
iii) Sale of Services (Consultancy)		710831	1054793	c) To other providers of funds			
iv) Group Insurance		0	49776	VI. Finance Charges (Interest)			
VI. Amount Borrowed				VII. Other Payments (Specify)			
VII. Any other receipts (give details) (Pension Contribution)				i) Advances to Staff		1836633	1711275
		0	46920	ii) Earnest Money Refunded		11500	10000
				iii) Advances to Parties		8387840	10949728
				iv) Group Insurance		0	77258
I) Recovery of Advances		2784933	2650214	VIII. Closing Balances			
ii) Earnest Money Deposit		25170	46865	a) Cash in hand		446	102
iii) FDR Matured		0	0	b) Bank Balances			
iv) Recovery from Parties		0	24200155	i) In current accounts		0	-73993
				ii) In deposit accounts			
				iii) Saving account			
				iv) Endowment deposit account		2760232	138131
				v) Excess Expenditure			
TOTAL		203963804	168134314	TOTAL		203963804	168134314

Chartered Accountants

Mukesh Kumar Agarwal
(Partner)

(S) Registrar

(Naresh C. Mehrotra)
Director



Conclave on Evolution : Life's Continuum
15th November, 2009



A view of Young Research personnel participating in various scientific and organizational activities